ARGENTINE REPUBLIC
DEPARTMENT OF AGRICULTURE

# CLIMATE OF THE ARGENTINE REPUBLIC

BY

WALTER G. DAVIS
Director of the Argentine Meteorological Office



BUENOS AIRES
Printing office of the Argentine Meteorological Office
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The original significance of the word climate, derived from the Greek *klima,* was declivity or inclination; its application to a terrestrial region indicated the gradation from the equator towards the pole, as an expression of the angle formed by the solar rays with the surface of the place. Later it was employed in the sense of what we now call *zone,* since in those times a change of climate involved a change of latitude. Ptolomy, in the second century, applied the term *klima* to the series of subdivisions of the earth between the equator and the north pole or zones bounded by parallels of latitude, whose circles differed from one another only in the duration of the solar day.

We accept as the present use of the term, climate, the combined effect of the different atmospheric manifestations or simply the mean of meteorological observations continued during a period sufficiently long to afford trustworthy values of each one of the physical elements of the atmosphere. Thus in this sense the climatology of a region is deduced from its meteorology, from observations made with apparatus which give an exact measure of each factor and are carried on for the time necessary to fix the limits of the corresponding variations. For example, the weather map which gives the atmospheric conditions prevailing at some given hour of the day, may be considered as the meteorological expression of the elements which give only indications of the climate of the region represented; but at the same hour of the following day the intensity of the manifestations of those elements is entirely changed, so that comparing the meteorological data of the two maps, distinctly different climatological conditions may be found. Now, uniting and coordinating the values of the temperature, humidity, precipitation, atmospheric pressure, velocity and direction of the wind, furnished by a long series of the maps, we obtain true means with their corresponding extremes for each one of those elements, with the daily, monthly and yearly deviations from the mean, also the probable period of recurrence, or the frequency, of the same phenomenon. The values thus obtained, together with the relations between them, give the climatological data of the place. In other words, the distinction between meteorology and climatology may be said to be that the former is the study of the physical elements of the atmosphere and the science upon which are based the laws of terrestrial circulation, while the latter represents the positive results applicable to studies designed for practical purposes, as the relations of climate to harvest, to industries and to health; in fact to all human interests and the requirements of the vegetable and animal kingdoms of our planet.

Considered in its broadest sense, it is recognised that climate depends on two

general factors, the most important being the sun, and the other the geographical constitution of the earth. It is evident that if the globe lacked hypsometric irregularities, and its surface were of the same capacity for the absorption and radiation of solar energy, which constitutes the first factor, that is the *solar climate*, temperatures would vary according to latitude, or in other words, according to the duration of the solar day, since along the same parallel, the angle of incidence of the solar rays would be the same and, consequently, their intensity equal for places equidistant from the equator.

The purely astronomical classification of the globe into five zones, generally known as the torrid, the two temperate and the two polar zones, corresponds, from the climatological point of view, to the division according to the zones of solar climate. It might have been more accurate to designate the torrid zone as that of summer, on account of the larger amount of insolation which it receives; the two polar zones as those of winter, by virtue of receiving the least insolation; and the two intermediate temperate zones as those of spring and autumn. The other great agent, the geographical or physical constitution of the earth, which operates to modify the solar climate along the same parallel of latitude, consists in the partition of the surface of the planet into land and water, and in the differences in the height of the land, thus originating what is known as physical climate. This in its turn is subdivided into maritime, littoral, mediterranean and mountainous climates, according to the character of the surface.

Within the territorial limits of Argentina the distinctions which correspond to the above mentioned great climatological divisions are quite pronounced, with a variety of subdivisions according to the intensity of the atmospheric factors which characterise the general classifications of the climates of the globe.

With the latitudinal extension of the Republic, which extends from two degrees north of the tropic of Capricorn to the regions within the Antarctic circle, the amplitude of the variation of insolation, or that of the *solar climate*, must be considerable. In fact, within the limits of our observations of the mean annual temperature, its amplitude is indicated by the isotherm of 24° C. in the north, and in the south, in the region of the Orkney Islands in 61° latitude, by—5°, thus showing an amplitude of 29° in a latitudinal extension of 40°, that is, a decrease of temperature at the rate of 0°.7 per degree of latitude.

The variation of the geographical or physical climate following the same parallel of latitude across the Republic is as great as that of the solar climate in its greatest extent from north to south, or even more so, since in the constantly increasing heights from east to west—from the level of the sea or the lowlands in the Littoral to the lofty snow-crowned peaks of the Andes—the temperature falls rapidly as one approaches the interior plains and ascends the Andean slopes. As regards the precipitation and humidity, the variations in the mean values found in the different regions are proportionately of greater amplitude than those of the temperature.

The division of the Republic into regions which present divergent climatic characteristics, principally with regard to variations of temperature and rainfall, is made according to the classification of the four zones, namely: the Littoral, which includes the provinces of Buenos Aires, Entre Rios, Santa Fe and Corrientes, and the territories of the Chaco, Formosa and Misiones; the Mediterrranean, which extends from the Bolivian boundary on the north to the Rio Negro, or approximately to the 40th parallel of south latitude; the Andean, which comprises the provinces at the eastern foot of the Cordilleras with the same

northern and southern limits as the Mediterranean and the Patagonian, which embraces the region to the south of Rio Negro to the southern extremity of Tierra del Fuego. To these may be added a fifth division falling under the dominion of the Argentine Republic, the Antarctic, covering the region situated south of Tierra del Fuego extending to within the Antarctic circle. The Littoral, Mediterranean and Patagonian divisions may each be subdivided into northern, central and southern sections in which the differences of climate are principally determined by the factor of latitude and elevation.

With the exception of the narrow strip north of the tropic of Capricorn and the barren islands within the Antarctic circle, the territory of the Republic lies in the temperate zone; but on account of the hypsometric differences, the constituents of the soil and the characteristics of the climate are so varied that there is scarcely any vegetable product for which there is not a region suitable for its successful cultivation.

For the production of wheat and the growth of forests, a lower limit for the mean temperature of the warmest month of the year has been fixed at 10°C., and 300 mm. of precipitation, equitably distributed. According to this criterion, we find even at the extreme southern confines of the Argentine mainland, conditions which fall within the above limits, since on the southern coast of Tierra del Fuego the mean temperature of the three summer months is somewhat above 10°. In the arid regions of the Andean and Patagonian zones, where the precipitation is less than 300 mm., the soil is fertile and responds so quickly to the small quantity of rain received that it produces nutritive pasturage, so that the greater part of this region, in place of being unproductive, offers conditions favourable for pastoral industries. With irrigation—which is praticable for a considerable area—abundant harvests are produced and frequently in apparently totally arid regions a rich vegetation springs up. Thus with the exception of the denuded slopes of the mountain chains, there is comparatively little land in the Republic which may not be utilised.

The atmospheric elements which directly determine the climatological zones are temperature, precipitation and the winds; but the variation in the intensity of these elements, which constitute the characteristic features of the different climates, depends to a great extent on the circulation of the atmospheric pressure, which in its turn responds to the influence exercised by the distribution of land and water areas. Thus before giving an explanation of the different climatological zones of the Republic, let us consider briefly the general movement of the atmosphere in the southern part of this continent and its relation to the temperature, humidity and rainfall.

As regards the atmospheric circulation, the Republic may be divided into two general systems. In the section to the north of the territory of Rio Negro, where the continent begins to widen from east to west, the continental or cyclonic movement is found; while to the south of Rio Negro the circulation corresponds to the Antarctic or anticyclonic movement. These two divisions may be designated respectively as Continental and Antarctic.

The region of the continental circulation lies between two permanent high pressure areas, one in the Atlantic and the other in the Pacific, the former being farther from the continent than the latter; so that the greatest depression between these two «highs» is found, on the mean of the year, in the interior of the continent, and in the summer the dividing line is represented by a narrow area of low pressure extending from north to south at the foot of the Cordilleras. In this re-

gion of continental circulation high and low pressure areas are formed, exercising their respective influences on the climate. In the Antarctic division, to the south of the forty-second degree of south latitude, the general movement of the air is much more constant, the isobars are parallel, running east and west, and the prevailing wind is westerly. It is but seldom that cyclonic areas form over the comparatively limited extension of land in this region.

The distinction between these two general systems of atmospheric movements may be seen more clearly in Plates I to V, which represent in the form of isobaric lines, the normal pressures reduced to sea level and to standard gravity, corresponding to 45° latitude. From the study of the weather maps, published since the beginning of the year 1902, ten types of weather have been deduced, that is, the courses most commonly followed, in this part of the continent, by the areas of high and low pressure, together with the manifestations of rain, winds and temperature changes produced by the different types. The following is a summary of these atmospheric movements:

### TYPES O HIGH PRESSURE AREAS.

N°. 1. Areas of high pressure which form in the Andean region north of Mendoza and move in a northeasterly direction, causing fresh to strong winds in the region north of Rio Negro. This type, preceded by an area of low pressure in the provinces of Cordoba and Santa Fe, presents one of the most characteristic types of wind, called the «pampero», and ordinarily, occasions a fall of temperature whose amount is proportional to the barometric gradient, i. e. to the difference in pressure between adjacent regions.

N°. 2. «Highs» which appear in the neighbourhood of Neuquen. It is probable that a large number of these originate in the mountain region where a marked decrease in the height of the central range allows the interchange of the lower currents of the two sides of the Andes, or the meeting of the warm dry air of he Atlantic side with the cooler, moisture-laden air of the Pacific. These «highs» generally move toward the northeast, and, like the preceding type, are of the «pampero» character. When these reach to the Atlantic coast, they as a rule brin grain, accompanied, in the spring and summer months, by electrical discharges.

N°. 3. «Highs» which, forming outside the continent, first appear in Chubut and Santa Cruz and move northward as far as the province of Cordoba, turning then toward the northeast. This type produces cloudy, damp weather and low temperatures throughout the Republic. In the winter the snows in the sierras of Buenos Aires, Cordoba and San Luis occur during the passage of this high pressure area.

N°. 4. «Highs» which appear in the south of Santa Cruz and Tierra del Fuego, coming from the southwest and entering the Atlantic before reaching Chubut; in general they cause light rains or snows in the region traversed, since the winds which they originate bring the moisture of the ocean condensed by contact with the strata of colder air over the land.

### TYPES OF LOW PRESSURE AREAS.

N°. 5. Areas of low pressure which form in Santa Fe and in the east of Cordoba, while there is a high pressure area in the Andean provinces and another in

eastern Brazil, thus forming an atmospheric depression with its axis of greatest elongation lying in a southeast to northwest direction. The general course of such depressions is toward the east or southeast, and they usually cause rains in Buenos Aires and the Littoral. The periods of prolonged rains correspond to this condition of cyclonic circulation. The passage of these cyclonic areas is attended by strong winds blowing first from the east and southeast and afterwards from the south, southwest and west, as the depression moves eastwards. On entering the Atlantic, the strongest winds are felt on the Uruguayan and South Brazilian coasts. In the winter months the development of this type of «low» is the certain forerunner of the «pampero», or type 1, since it is followed by pronounced high pressures in the Andean region and the fall of snow in the Cordilleras.

N°. 6. «Lows» which form in the north of the Republic or, more accurately, in the province of Santiago del Estero and the territories of Formosa and the Chaco, and move toward the ESE., causing rains in Santiago del Estero, northern Cordoba and throughout the Littoral as far as the north of Buenos Aires.

N°. 7. «Lows» which form in the territory of the Pampa Central and travel to the NE., producing rains in Buenos Aires, in all the Mediterranean region except the extreme north, and usually throughout the Littoral. In the summer time this same type, when large but not well developed, causes, while still in the region where it formed, local showers and thunderstorms in Buenos Aires and in the south of Cordoba and Santa Fe.

N°. 8. «Lows» which are first observed when they appear in the territory of Neuquen moving to the N. and NE. They cause rains in Neuquen, Rio Negro, the Pampa, Buenos Aires, Cordoba, Entre Rios, Santa Fe and Corrientes. This type, when well developed, indicates bad weather on the Chilian coast, with high winds north of the 40th parallel, especially in the neighbourhood of Valparaiso.

N°. 9. «Lows» which appear in western Chubut and move to the E. and NE., causing rains in Neuquen, Rio Negro, the south of the Pampa Central and the southwest of Buenos Aires.

N°. 10. «Lows» which move across Tierra del Fuego and the south of Santa Cruz, travelling to the E. and NNE., producing rains in Santa Cruz and Chubut. In several cases it has been possible to follow the course of depressions of this type across the Atlantic till they reached the extreme south of Africa about 4 to 6 days after they appear in the south of this continent. In general, they are dissipated in mid-ocean as shown by observations made on shipboard. «Lows» of this type in moving to the NE. cause high westerly winds along the coast as far north as the province of Buenos Aires.

The mean annual pressure values in the Continental division are above 760 mm., varying from 760 to 762.5, reduced to sea level, but in the Antarctic division the values decrease rapidly with increasing latitude. Starting at latitude 40° with a mean annual pressure of 760 mm., in latitude 45° it has fallen to 757 mm.; in 50°, i. e., about the latitude of Santa Cruz, to 753; in latitude 55°, the southern coast of Tierra del Fuego, to 748 mm., and in the South Orkneys, in latitude 61°, to 742 mm. Observations made by Dr. Charcot from February 1904 to January 1905, during the stay of the expedition in Wandel Island, in 65° latitude, gave the mean value of 745 mm. On account of the scarcity of data it is impossible to say how far towards the south pole this decrease of pressure continues, but according to the observations made in the «Discovery», there is evidence that the lowest pressures

are found between the 65th and 70th parallels and that from this circumpolar zone the pressure begins to rise, showing higher values in the interior of the Antarctic continent. It seems probable that, over the great land area which surrounds the pole, a permanent anticyclonic area exists to whose position in relation to the rotation of the earth are due the strong winds which blow with such violence in the southern ocean.

The region which we are studying presents very pronounced differences with regard to the diurnal and annual variations of the barometer and also to its aperiodic fluctuations, the characteristics varying according to the latitude and elevation of the land. In the diurnal variation of pressure the two *maxima* and the two *minima* are shown in all the series of observations. In the low latitudes they are strongly marked and in the high latitudes scarcely recognizable. In general, the principal *maximum* occurs about 9 a. m. and the principal *minimum* between 3 and 5 p. m. The secondary *maximum* is found between 10 and 12 p. m. and the secondary *minimum* between 3 and 5 a. m. From Tierra del Fuego southward, the night *maximum* is more pronounced than that of the morning, but in high latitudes the variations shown in the daily curve are appreciable only in the means formed from long series of observations, while in the subtropical region, the variation is so pronounced that a day in which it is not shown is quite exceptional; on the majority of days the *maximum* and *minimum* are so accentuated that the barograph trace may serve to indicate the time of day. In the region of high plains and in the mountains the amplitude of the diurnal variation is less than in the lowlands.

The difference between the principal *maximum* and *minimum* of the day, on the curves for the year, are:—

| | |
|---|---|
| Asuncion (Paraguay)........................... | 2.4 mm. |
| Cordoba........................................... | 2.3 mm. |
| Buenos Aires.................................... | 1.6 mm. |
| Patagones......... ............................... | 1.4 mm. |
| Ushuaia............................................ | 0.7 mm. |
| South Orkneys.................................. | 0.4 mm. |

The annual variation of the barometer, as well as the diurnal, varies with the height above sea level and to a lesser extent with latitude, the amplitude of the variation decreasing with an increase of either latitude or altitude. In the Littoral and Mediterranean regions, north of the 35th parallel, the annual curve shows the *minimum* in the months of December and January with a *maximum* which occurs in June and July, the amplitude varying from 7 mm. in the north to 5 mm. in the south. In the Andean region, the elevated lands at the foot of the Cordilleras have two *maxima*. The curves illustrated by the observations of Mendoza and of Chos-Malal, show, at heights of 800 to 900 m., the first *maximum* occurring in April and the second in September, with an amplitude of 3.5 mm. between the principal *maximum* and *minimum*. To the north, on the table-land of Jujuy, at a height of 3500 m. above the sea, there is very little difference between the summer and winter values, and in the mountain peaks, even though at lesser heights than the above mentioned table-land, the variation is the reverse of that found in the low regions. This is shown by the observations at Paramillo de Uspallata, at a height of 2845 m. above the sea, which give the pressure for the three summer months as 3 mm. higher than that for the winter. In the extreme south of the

continent and in the Antarctic region the curve is extremely irregular but always shows a tendency towards the double *maxima* and *minima*.

The abnormal fluctuations increase with an increase of latitude and decrease with elevation, so that in the regions of the greatest diurnal variation we find the least abnormal fluctuations. This may be seen by the following figures which give the annual mean of the extreme variation for a line of stations running from north to south.

| | Latitude | Height | Average extreme annual variation |
|---|---|---|---|
| Asuncion (Paraguay)......... | 25° | 105 m. | 14 mm. |
| Corrientes......................... | 27° | 77 » | 15 » |
| Parana............................ | 32° | 78 » | 17 » |
| Buenos Aires.................... | 35° | 22 » | 18 » |
| Bahia Blanca...................... | 39° | 19 » | 21 » |
| Com. Rivadavia................. | 46° | 10 » | 27 » |
| Santa Cruz........................ | 50° | 12 » | 31 » |
| Staten Island...................... | 54° | 12 » | 32 » |
| South Orkneys.................... | 61° | 6 » | 49 » |

## TEMP RATURE.

Charts VI to X show the isothermal lines for the seasons and for the entire year, referred to the ten-year period beginning with 1898. The values used in the preparation of these maps are the true diurnal temperatures, i. e., the mean of the 24 hourly observations or of a lesser number reduced to that mean, and are the observed temperatures, not reduced to the level of the sea, since in that case it would have been necessary to apply an additive correction of 1° Celsius for each 200 m. of elevation. Charts XI and XII show the mean *maxima* and *minima* temperatures corresponding to the ten-year period, while charts XIII and XIV represent the absolute *maximum* and *minimum*. In making these maps, observations not taken in louvered shelters were excluded, so that the thermometers were exposed under the same conditions.

A comparison of these three systems of isothermal charts shows the general features of the distribution of insolation, and, at the same time, is of interest as indicating that the regions of greatest and least mean annual temperature do not coincide with the extremes. In chart XIII it may be seen that the region in which the highest temperatures have been observed is that enclosed by the isotherm of 46° and embraces the greater part of the province of Santiago del Estero, the territory of the Chaco and the northwest of Santa Fe, entering into the territory of Formosa. The very highest temperature registered by the maximum thermometer was 46°.8 and occurred in Chilca, province of Santiago del Estero. Temperatures somewhat higher than this have been noted in the arid districts in the north of the Mediterranean region, but these were not considered trustworthy since the exposure of the instruments created some doubt as to the accuracy of the observations. The most striking feature of the distribution of *maximum* temperature is the southward

prolongation of the isotherm of 42° which extends to the territory of Chubut, showing that to the 43rd degree of latitude the temperature at times rises as high as in the north of the Republic or in Paraguay, while at the southern extremity of this isotherm the mean annual temperature is some 11° lower than that in the north of the region having the same absolute *maximum*. These conditions recur nearly every year, it being an exceptional summer when the daily *maxima* do not rise as high in Rio Negro and the Pampa as in Misiones and Paraguay. The phenomenon is explained by the difference in the humidity and in the amount of cloudiness, since in the north of the Littoral the soil is covered with a subtropical vegetation, the sky is more clouded and the quantity of aqueous vapour is about double that which is commonly found in the south of the Mediterranean region where the vegetation is scarce and the sky more clear. It will be easily understood that in regions so different the physical conditions dominate the solar action in determining the *maximum* temperature.

On the other hand, as regards the *minimum* temperature, it is seen, by chart XIV, that in the Republic there is no region exempt from temperatures below 0°. In the extreme north of the Littoral the frosts are so scarce that even the most delicate plants seldom suffer from them, so that for agricultural and horticultural purposes they are scarcely to be feared. In the Patagonian region, however, the severity of the frosts is such that agriculture must be limited to the cultivation of the hardiest species.

According to our system of meteorological stations, in the southern territories the most intense cold was observed in the south of Chubut in the month of June 1907, at Colonia Sarmiento and Buen Pasto the *minimum* temperature of — 33° was registered and at other stations in the same region — 29° and — 28°. Thus, between the *maximum* temperature of 46°.8 in the province of Santiago del Estero, and the *minimum* of — 33° in Chubut, we find an extreme amplitude of 79°.8 corresponding to the last ten years' observations on the mainland of the Republic, but in the South Orkneys the temperature has fallen to — 41°, giving an amplitude of 88° Celsius between the 28th and 61st parallels of latitude.

In Tierra del Fuego and the interior of Santa Cruz and Chubut, temperatures below 0° have been observed in every month of the year; on the plains of Rio Negro from March to December, in the Pampa and the west of Buenos Aires, from February to November. As we proceed northward, through the Littoral and Mediterranean regions, the period of frosts becomes shorter, till, in the extreme northeast, the negative sign is eliminated from the temperature records.

Crossing the Republic from east to west, north of latitude 40°, the variation of temperature in the Littoral differs from th t of the interior in having less amplitude both in the diurnal and annual fluctuations. The changes, although at times marked and rapid, are not in general so frequent or so large as those experienced in the Mediterranean and Andine regions.

## RAINFALL D STRIBUTION.

Of all the climatological elements the precipitation is the one which shows the greatest variations in the amount that falls from year to year as well as in the annual distribution. To the north of latitude 38° the year may be divided into two seasons, the rainy and the dry, corresponding respectively to the periods from October to March and from April to September. In the Littoral, the distribution

is more equitable in the southern than in the northern section, since in the city of Buenos Aires 56 °/₀ of the annual amount falls in the rainy period, and in Corrientes 65 °/₀; in the Mediterranean region, represented by the rains of Cordoba, 86 °/₀, and in Salta, in the Andean region, 96 °/₀. To the south of latitude 38° the distribution, both as to frequency and quantity, is more uniform, with the result that, in general, there is little difference between the rains of summer and those of winter except in the western section of the territory of Neuquen where the torrential winter rains are more than double the summer precipitation.

Charts XV, XVI and XVII illustrate the distribution of rain, for the wet and dry periods and for the year, by means of isohyetic divisions, corresponding to differences of 100 mm. in the first two and to 200 mm. in the last. The results presented in these charts are deduced from observations made at more than 600 stations, in the greater number of which the period is at least ten years.

Referring to the graphic representation, it is seen that the region of greatest precipitation is in the west of the territory of Neuquen where the mean annual rainfall is more than 1800 mm., while on the Chilian coast, in the same latitude, it is about 2500 mm. In this latitude — 38° to 41° — the winds from the Pacific blow, throughout the year, towards the land, bringing the moisture of the ocean, which condenses on coming into contact with the land, or through the cooling of the air as it rises over the slopes of the Cordilleras. The condensation is still more enhanced by the interchange of the currents of widely different temperature and humidity which prevail on the opposite sides of the Andes. The rapid decrease in the rainfall eastward from the zone of *maximum* precipitation is noteworthy, since at a distance of about 200 kilometres the mean annual quantity is scarcely 300 mm.

After the region mentioned, the one most benefited is in the north of the Littoral, with an annual mean of 1600 mm.; but, in crossing the Republic on the same parallel of latitude, on reaching the table-lands at the foot of the Andes, this amount is diminished to only 100 mm. In the zone between 30° and 35° of latitude a diminution in the quantity of rain is observed from east to west at the rate of 100 mm. of rain for every 100 kilometres of distance; i. e. starting from the Uruguay river with an annual rainfall of 900 to 1000 mm., on reaching the provinces of Mendoza and San Juan it is less than 200 mm.

As regards the number of rains, there is as much divergence between the different zones as in the amount of rainfall. The extremes, according to our network of pluviometric stations, are a *maximum* of 251 days of rain a year in Staten Island, derived from seven years' observations, and a *minimum* in the city of San Juan, with a mean of 16 days of rain.

With respect to the differences in the annual quantities, the Littoral region shows greater variations than the interior; for example, in the city of Buenos Aires the mean of 47 years of observations is 930 mm., with the extremes of 547 mm. in 1893 and 2025 mm. in 1900; while in Cordoba, in the centre of the Mediterranean region, with a mean quantity of 696 mm., resulting from a series of 35 years of observations, the amplitude is represented by the *minimum* of 420 mm. in 1880 and the *maximum* of 1007 mm. in 1889.

Having indicated the general features of the principal physical factors which determine the climate of the Republic, we will proceed to show more in detail, by means of numerical and graphical illustrations, the climatological conditions which characterise the different zones into which the Republic is divided.

## THE LITTORAL ZONE.

This zones includes the regions contiguous to the La Plata, Uruguay, Parana, Upper Parana and Paraguay rivers, and the Atlantic coast as far as the southern extremity of the province of Buenos Aires, in latitude 41°, with its northern limit at the Bolivian frontier, in latitude 22°. It includes the entire province of Buenos Aires, but the western part of this province might be better classified as belonging to the Mediterranean region.

In the extreme northwest of the region, in the Chaco, the general elevation of the ground reaches 300 metres, but near the banks of the Upper Paraguay, it is about 100 metres. With the exception of the hills in the interior of Misiones, the height of the greater part of the Littoral is less than 120 metres.

### ATMOSPHERIC PRESSURE.

To illustrate the diurnal and annual variations of the barometer, the three widely separated stations of Asuncion (Paraguay), characteristic of the Chaco region, Buenos Aires and Patagones, have been selected. The diurnal variation is shown by the hourly values which follow, for the four seasons (1) and the year.

(1). In the classification by seasons, summer is considered to begin with December, autumn with March, winter with June, and spring with September.

## DIURNAL VARIATION OF ATMOSPHERIC PRESSURE.

| Hour | Asuncion *(altitude 95 metres)* Summer | Autumn | Winter | Spring | Year | Buenos Aires *(altitude 28 metres)* Summer | Autumn | Winter | Spring | Year |
|---|---|---|---|---|---|---|---|---|---|---|
| | mm. | mm. | mm. | mm. | mm. | mm. | mm. | mm. | mm. | mm. |
| 1 a. m. | 750.3 | 753.3 | 755.4 | 752.5 | 752.9 | 757.8 | 760.5 | 762.7 | 761.1 | 760.5 |
| 2 | 50.1 | 53.2 | 55.2 | 52.4 | 52.7 | 57.7 | 60.5 | 62.6 | 61.0 | 60.5 |
| 3 | 50.0 | 53.0 | 55.1 | 52.3 | 52.6 | 57.7 | 60.4 | 62.5 | 61.0 | 60.4 |
| 4 | 50.1 | 53.0 | 55.0 | 52.4 | 52.6 | 57.8 | 60.4 | 62.5 | 61.0 | 60.4 |
| 5 | 50.4 | 53.2 | 55.0 | 52.6 | 52.8 | 58.0 | 60.5 | 62.5 | 61.2 | 60.5 |
| 6 | 50.8 | 53.5 | 55.3 | 53.0 | 53.1 | 58.3 | 60.7 | 62.6 | 61.4 | 60.8 |
| 7 | 51.2 | 53.9 | 55.7 | 53.4 | 53.5 | 58.6 | 60.9 | 62.8 | 61.7 | 61.0 |
| 8 | 51.5 | 54.2 | 56.0 | 53.7 | 53.8 | 58.7 | 61.1 | 63.0 | 61.8 | 61.1 |
| 9 | 51.6 | 54.4 | 56.3 | 53.8 | 54.0 | 58.6 | 61.2 | 63.1 | 61.7 | 61.2 |
| 10 | 51.5 | 54.4 | 56.4 | 53.7 | 54.0 | 58.5 | 61.2 | 63.2 | 61.6 | 61.1 |
| 11 | 51.3 | 54.2 | 56.1 | 53.4 | 53.8 | 58.3 | 61.0 | 63.0 | 61.4 | 60.9 |
| Noon | 51.0 | 53.7 | 55.6 | 53.0 | 53.4 | 58.1 | 60.6 | 62.6 | 61.2 | 60.6 |
| 1 p. m. | 50.5 | 53.1 | 54.9 | 52.4 | 52.8 | 57.8 | 60.2 | 62.2 | 60.8 | 60.2 |
| 2 | 49.9 | 52.6 | 54.4 | 51.8 | 52.2 | 57.4 | 59.9 | 61.9 | 60.4 | 59.9 |
| 3 | 49.4 | 52.3 | 54.1 | 51.4 | 51.8 | 57.1 | 59.7 | 61.8 | 60.2 | 59.7 |
| 4 | 49.1 | 52.2 | 54.1 | 51.2 | 51.7 | 56.9 | 59.7 | 61.8 | 60.1 | 59.6 |
| 5 | 48.9 | 52.2 | 54.3 | 51.3 | 51.8 | 56.8 | 59.7 | 61.9 | 60.2 | 59.7 |
| 6 | 49.0 | 52.4 | 54.5 | 51.4 | 51.8 | 56.9 | 60.0 | 62.1 | 60.3 | 59.8 |
| 7 | 49.4 | 52.6 | 54.7 | 51.7 | 52.1 | 57.1 | 60.1 | 62.3 | 60.6 | 60.0 |
| 8 | 49.8 | 53.0 | 55.0 | 52.1 | 52.5 | 57.4 | 60.2 | 62.5 | 60.8 | 60.2 |
| 9 | 50.2 | 53.3 | 55.2 | 52.4 | 52.8 | 57.6 | 60.4 | 62.6 | 61.1 | 60.4 |
| 10 | 50.5 | 53.5 | 55.4 | 52.6 | 53.0 | 57.8 | 60.5 | 62.7 | 61.1 | 60.5 |
| 11 | 50.6 | 53.5 | 55.5 | 52.7 | 53.1 | 57.9 | 60.6 | 62.8 | 61.1 | 60.6 |
| Midnight | 50.5 | 53.4 | 55.4 | 52.6 | 53.0 | 57.9 | 60.6 | 62.8 | 61.1 | 60.6 |
| Mean........... | 750.3 | 753.3 | 755.2 | 752.5 | 752.8 | 57.8 | 60.4 | 62.5 | 61.0 | 60.4 |

**Patagones** *(altitude 30 metres)*

| Hour | Summer | Autumn | Winter | Spring | Year | Hour | Summer | Autumn | Winter | Spring | Year |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | mm. | mm. | mm. | mm. | mm. | | mm. | mm. | mm. | mm. | mm. |
| 1 a. m. | 755.0 | 757.5 | 759.5 | 758.3 | 757.6 | 1 p.m. | 755.0 | 757.1 | 759.0 | 758.1 | 757.3 |
| 2 | 54.9 | 57.4 | 59.4 | 58.2 | 57.5 | 2 | 54.7 | 56.9 | 58.8 | 57.8 | 57.0 |
| 3 | 55.0 | 57.3 | 59.3 | 58.2 | 57.5 | 3 | 54.4 | 56.7 | 58.7 | 57.5 | 56.8 |
| 4 | 55.2 | 57.3 | 59.3 | 58.3 | 57.5 | 4 | 54.2 | 56.7 | 58.8 | 57.4 | 56.8 |
| 5 | 55.5 | 57.4 | 59.3 | 58.5 | 57.7 | 5 | 54.1 | 56.8 | 58.9 | 57.5 | 56.8 |
| 6 | 55.7 | 57.6 | 59.5 | 58.7 | 57.9 | 6 | 54.2 | 56.9 | 59.1 | 57.6 | 56.9 |
| 7 | 55.9 | 57.8 | 59.6 | 58.9 | 58.1 | 7 | 54.4 | 57.1 | 59.3 | 57.8 | 57.2 |
| 8 | 56.0 | 57.9 | 59.8 | 59.0 | 58.2 | 8 | 54.7 | 57.3 | 59.4 | 58.1 | 57.4 |
| 9 | 55.9 | 58.0 | 59.9 | 59.0 | 58.2 | 9 | 54.9 | 57.4 | 59.5 | 58.3 | 57.5 |
| 10 | 55.8 | 58.0 | 59.9 | 58.9 | 58.1 | 10 | 55.0 | 57.5 | 59.5 | 58.3 | 57.6 |
| 11 | 55.5 | 57.8 | 59.7 | 58.6 | 57.9 | 11 | 55.1 | 57.5 | 59.6 | 58.3 | 57.6 |
| Noon | 55.3 | 57.5 | 59.4 | 58.4 | 57.7 | Midnight | 55.1 | 57.5 | 59.6 | 58.3 | 57.6 |
| | | | | | | Mean | 755.1 | 757.4 | 759.4 | 758.2 | 757.5 |

The mean time of occurrence of the pressure extremes, with their corresponding values, and the amplitude of the variation, are as follows:—

**Asuncion**

| | Minimum I | | Maximum I | | Minimum II | | Maximum II | | Amplitude |
|---|---|---|---|---|---|---|---|---|---|
| | Hour | Pressure | Hour | Pressure | Hour | Pressure | Hour | Pressure | |
| | A. M. h m | mm. | A. M. h m | mm. | P. M. h m | mm. | P. M. h m | mm. | mm. |
| Summer...... | 3 0 | 750.0 | 9 20 | 751.6 | 5 20 | 748.9 | 11 0 | 750.6 | 2.7 |
| Autumn....... | 3 30 | 53.0 | 9 30 | 54.5 | 4 20 | 52.2 | 10 50 | 53.5 | 2.3 |
| Winter........ | 4 0 | 55.0 | 9 40 | 56.5 | 3 35 | 54.1 | 11 30 | 55.5 | 2.4 |
| Spring......... | 3 0 | 52.3 | 9 15 | 53.8 | 4 30 | 51.2 | 10 45 | 52.7 | 2.6 |
| Year. ......... | 3 20 | 752.6 | 9 30 | 754.1 | 4 30 | 751.6 | 11 0 | 753.1 | 2.5 |

**Buenos Aires**

| | Minimum I | | Maximum I | | Minimum II | | Maximum II | | Amplitude |
|---|---|---|---|---|---|---|---|---|---|
| | Hour | Pressure | Hour | Pressure | Hour | Pressure | Hour | Pressure | |
| | A. M. h m | mm. | A. M. h m | mm. | P. M. h m | mm. | P. M. h m | mm. | mm. |
| Summer...... | 2 35 | 757.7 | 8 25 | 758.7 | 5 20 | 756.8 | 12 25 | 757.9 | 1.8 |
| Autumn...... | 3 30 | 60.4 | 9 15 | 61.2 | 4 0 | 59.7 | 11 25 | 60.6 | 1.5 |
| Winter. ...... | 4 20 | 62.5 | 9 30 | 63.2 | 3 15 | 61.7 | 11 30 | 62.8 | 1.5 |
| Spring......... | 3 10 | 61.0 | 8 30 | 61.8 | 3 10 | 60.1 | 11 10 | 61.2 | 1.7 |
| Year............ | 3 0 | 760.4 | 9 0 | 761.2 | 4 10 | 759.6 | 11 20 | 760.6 | 1.6 |

**Patagones**

| | Minimum I | | Maximum I | | Minimum II | | Maximum II | | Amplitude |
|---|---|---|---|---|---|---|---|---|---|
| | Hour | Pressure | Hour | Pressure | Hour | Pressure | Hour | Pressure | |
| | A. M. h m | mm. | A. M. h m | mm. | P. M. h m | mm. | P. M. h m | mm. | mm. |
| Summer...... | 2 0 | 754.9 | 7 30 | 756.0 | 5 0 | 754.1 | 11 20 | 755.1 | 1.9 |
| Autumn...... | 3 30 | 57.3 | 9 20 | 58.0 | 3 50 | 56.7 | 11 30 | 57.6 | 1.3 |
| Winter........ | 4 20 | 59.3 | 9 30 | 59.9 | 3 0 | 58.7 | 11 25 | 59.6 | 1.1 |
| Spring...... .. | 3 10 | 58.2 | 8 10 | 59.0 | 4 20 | 57.4 | 11 30 | 58.4 | 1.6 |
| Year........... | 3 0 | 757.5 | 8 30 | 758.2 | 4 15 | 756.8 | 11 30 | 757.7 | 1.4 |

The graphic representation of the above values is found in Plate XVIII. The annual pressure variation is shown by the monthly values which follow;

| MONTH | Asuncion | B. Aires | Patagones |
|---|---|---|---|
| | mm. | mm. | mm. |
| January............ | 750.1 | 757.5 | 754.9 |
| February.......... | 50.7 | 58.2 | 55.5 |
| March.............. | 51.6 | 59.2 | 56.1 |
| April................ | 53.6 | 61.0 | 58.0 |
| May.................. | 54.6 | 61.3 | 58.0 |
| June................. | 55.8 | 62.3 | 59.3 |
| July... .............. | 55.1 | 62.4 | 58.6 |
| August ............. | 54.8 | 62.4 | 60.2 |
| September ......... | 54.1 | 62.5 | 59.9 |
| October............ | 52.5 | 60.7 | 58.5 |
| November.......... | 50.9 | 58.9 | 56.3 |
| December.......... | 50.2 | 57.7 | 54.8 |
| Year ........... | 752.8 | 760.3 | 757.5 |

The curves deduced from the preceding values are drawn in Plate XIX. From them it is seen that the epoch of the *maximum* for the year occurs some two months earlier in the north of the Littoral than in the south, while that of the *minimum* is nearly constant.

The relation between the atmospheric pressure and the wind is so intimate that on many days the barograph trace indicates the general direction of the air movement, since, as a rule, the barometric column falls with a northerly wind and rises with a southerly. This relation varies according to the season of the year, and the geographical and physical situation of the place. In the zone we are considering, it is of interest to note the variation in the effect of the wind from diverse directions on the barometric pressure for the three places whose daily and annual variations have been given. The values here given are for the year and represent deviations from the mean pressure, corresponding to the wind, from each of the eight principal directions.

| | N. | NE. | E. | SE. | S. | SW. | W. | NW. |
|---|---|---|---|---|---|---|---|---|
| | mm. | mm. | mm. | mm. | mm. | mm. | mm. | mm. |
| Asuncion............ | —2.3 | —1.1 | +0.2 | +1.6 | +2.1 | +0.9 | —0.8 | —0.7 |
| Buenos Aires ...... | —1.3 | 0.0 | +1.4 | +1.6 | +1.2 | +0.1 | —0.3 | —1.8 |
| Patagones........... | —0.1 | +1.1 | +1.9 | +2.4 | +0.6 | —1.3 | —2.4 | —2.2 |

TEMPERATURE.

Chart V shows that the mean annual temperature of the Littoral varies from 24° in the north to 14° in the south. Thus the region has an amplitude of 10° of insolation. The general direction of the isotherms is from east to west, but those of 14° and 15° are deflected to the southwest shortly after leaving the Atlantic coast. From the regular distribution of the lines, in a north and south direction, it is evident that throughout this section the solar climate predominates over the

physical except in the hilly region in the southeast section of the province of Buenos Aires. To this irregularity of the surface is undoubtedly due the change in the direction of the isotherms 14° and 15°, and consequently the modification of the climate in the southwestern part of this province and in the Pampa, the resulting mean temperatures being 2° to 3° higher than those corresponding to that latitude, and the rainfall decreasing more rapidly due to the obstruction which the hills offer to the humidity carried by the Atlantic winds.

To show the character of the diurnal temperature variation, the following table shows the hourly values, grouped by seasons, for the same places chosen to illustrate the atmospheric pressure. The temperatures for Buenos Aires are taken from two years' series of observations made at the Chacarita Meteorological Station, situated in the grounds of the Instituto Superior de Agronomía y Veterinaria at Villa Ortuzar, some five kilometres from the river, in the open country. A long series was made at different exposures in the city, where the proximity to the water and the influence of the agglomeration of buildings have the effect of decreasing the amplitude of the diurnal variation. Due to these influences the nocturnal temperature of the city is, in general, about 2° or 3° higher than in the open surrounding country and the diurnal *maximum* 1° or 2° lower, but the mean temperature of the 24 hours differs but little between the city and the country.

DIURNAL VARIATION OF TEMPERATURE.

| Hour | Asuncion | | | | | Buenos Aires | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Summer | Autumn | Winter | Spring | Year | Summer | Autumn | Winter | Spring | Year |
| | o | o | o | o | o | o | o | o | o | o |
| 1 a. m. | 23.4 | 19.7 | 16.2 | 19.7 | 19.7 | 19.1 | 14.6 | 8.0 | 12.2 | 13.5 |
| 2 | 23.0 | 19.4 | 15.9 | 19.4 | 19.4 | 18.6 | 14.3 | 7.7 | 11.8 | 13.1 |
| 3 | 22.7 | 19.1 | 15.6 | 19.0 | 19.1 | 18.1 | 13.9 | 7.5 | 11.4 | 12.7 |
| 4 | 22.4 | 18.7 | 15.3 | 18.7 | 18.8 | 17.7 | 13.7 | 7.3 | 11.2 | 12.5 |
| 5 | 22.2 | 18.6 | 15.1 | 18.4 | 18.6 | 17.5 | 13.3 | 7.3 | 11.2 | 12.3 |
| 6 | 22.4 | 18.5 | 14.9 | 18.6 | 18.6 | 18.8 | 13.3 | 6.9 | 12.2 | 12.8 |
| 7 | 24.2 | 19.4 | 15.1 | 20.2 | 19.7 | 20.7 | 14.4 | 7.1 | 13.8 | 14.0 |
| 8 | 26.4 | 21.5 | 16.7 | 22.3 | 21.7 | 22.5 | 16.2 | 8.4 | 15.4 | 15.6 |
| 9 | 28.4 | 23.7 | 18.7 | 24.1 | 23.7 | 23.9 | 17.7 | 9.8 | 16.7 | 17.0 |
| 10 | 29.8 | 25.1 | 20.2 | 25.5 | 25.1 | 25.1 | 19.0 | 11.2 | 17.8 | 18.3 |
| 11 | 31.0 | 26.3 | 21.4 | 26.6 | 26.3 | 26.1 | 20.1 | 12.2 | 18.6 | 19.2 |
| Noon | 31.7 | 27.0 | 22.2 | 27.5 | 27.1 | 26.7 | 20.8 | 12.9 | 19.2 | 19.9 |
| 1 p. m. | 32.2 | 27.5 | 22.9 | 28.1 | 27.7 | 27.2 | 21.3 | 13.2 | 19.5 | 20.3 |
| 2 | 32.4 | 27.5 | 23.1 | 28.2 | 27.8 | 27.4 | 21.4 | 13.4 | 19.5 | 20.4 |
| 3 | 32.1 | 26.9 | 22.7 | 27.8 | 27.4 | 27.3 | 21.4 | 13.2 | 19.3 | 20.3 |
| 4 | 31.5 | 26.1 | 22.0 | 27.1 | 26.7 | 26.8 | 20.8 | 12.6 | 18.8 | 19.8 |
| 5 | 30.4 | 24.7 | 20.6 | 26.0 | 25.4 | 25.8 | 19.4 | 11.2 | 17.8 | 18.6 |
| 6 | 28.9 | 23.3 | 19.1 | 24.3 | 23.9 | 24.3 | 17.8 | 10.3 | 16.2 | 17.2 |
| 7 | 26.9 | 21.9 | 18.2 | 22.7 | 22.4 | 22.5 | 16.9 | 9.8 | 15.1 | 16.1 |
| 8 | 25.9 | 21.4 | 17.8 | 22.0 | 21.8 | 21.6 | 16.4 | 9.5 | 14.5 | 15.5 |
| 9 | 25.2 | 21.0 | 17.4 | 21.4 | 21.2 | 20.9 | 15.9 | 9.1 | 13.9 | 15.0 |
| 10 | 24.7 | 20.6 | 17.1 | 21.0 | 20.9 | 20.5 | 15.6 | 8.8 | 13.5 | 14.6 |
| 11 | 24.2 | 20.2 | 16.8 | 20.6 | 20.5 | 20.0 | 15.2 | 8.5 | 13.2 | 14.2 |
| Midnight | 23.8 | 20.0 | 16.5 | 20.2 | 20.1 | 19.6 | 14.8 | 8.3 | 12.7 | 13.8 |
| Mean......... | 26.8 | 22.4 | 18.4 | 22.9 | 22.7 | 22.4 | 17.0 | 9.7 | 15.2 | 16.1 |

| Patagones | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Hour | Summer | Autumn | Winter | Spring | Year | Hour | Summer | Autumn | Winter | Spring | Year |
| | o | o | o | o | o | | o | o | o | o | o |
| 1 a. m. | 17.4 | 13.0 | 6.3 | 11.0 | 11.9 | 1 p. m. | 26.3 | 19.7 | 11.2 | 19.1 | 19.1 |
| 2 | 17.0 | 12.7 | 6.1 | 10.7 | 11.6 | 2 | 26.7 | 20.0 | 11.6 | 19.5 | 19.4 |
| 3 | 16.7 | 12.4 | 5.9 | 10.4 | 11.4 | 3 | 26.8 | 19.8 | 11.5 | 19.4 | 19.4 |
| 4 | 16.4 | 12.2 | 5.7 | 10.2 | 11.1 | 4 | 26.2 | 19.3 | 10.9 | 19.1 | 18.9 |
| 5 | 16.4 | 11.9 | 5.5 | 9.9 | 10.9 | 5 | 25.3 | 18.2 | 9.8 | 18.1 | 17.8 |
| 6 | 17.3 | 11.8 | 5.4 | 10.2 | 11.2 | 6 | 23.8 | 16.9 | 8.9 | 16.7 | 16.6 |
| 7 | 19.0 | 12 2 | 5.4 | 11.5 | 12.0 | 7 | 21.9 | 15.6 | 8.2 | 14.9 | 15.2 |
| 8 | 20.5 | 13.3 | 5.8 | 13.0 | 13.2 | 8 | 20.4 | 14.9 | 7.7 | 13.7 | 14.2 |
| 9 | 21.9 | 14.9 | 6.9 | 14.7 | 14.6 | 9 | 19.4 | 14.3 | 7.4 | 12.7 | 13.4 |
| 10 | 23.2 | 16.4 | 8 2 | 16.0 | 16.0 | 10 | 18.8 | 13.9 | 7.1 | 12.2 | 13.0 |
| 11 | 24.5 | 17.9 | 9.6 | 17.4 | 17.4 | 11 | 18.2 | 13.5 | 6.8 | 11.7 | 12.6 |
| Noon | 25.5 | 19.0 | 10.6 | 18.4 | 18.4 | Midnight | 17.8 | 13.2 | 6.5 | 11.4 | 12.2 |
| | | | | | | Mean | 21.1 | 15.3 | 7.9 | 14.2 | 14.6 |

A graphic representation of the figures given in the preceding table is found in Plate XX, from which it is seen that the form of the curve is practically the same throughout the Littoral.

The diurnal *maximum* of temperature occurs in all seasons of the year approximately two hours after the sun passes the meridian, and the *minimum* in the interval of a few minutes before sunrise to an hour after, varying according to the season of the year and the latitude of the place. The annual variation is shown by the *maximum* and mean *minimum* and the absolute *maximum* and *minimum* taken from twelve well-distributed stations. In this table the mean monthly temperature is the mean of the twenty-four hourly values, referred to the ten years, 1898 to 1907. The mean *maximum* and mean *minimum* are the monthly means of the highest and lowest temperatures observed daily, while the absolute values are the extremes noted during the entire series of observations.

ANNUAL VARIATION OF TEMPERATURE IN THE LITTORAL.

| MONTH | Asuncion | | | | | Posadas | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | Mean Max. | Mean Min. | Absol. Max. | Absol. Min. | Mean | Mean Max. | Mean Min. | Absol. Max. | Absol. Min. |
| | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° |
| January | 26.9 | 34.2 | 21.6 | 40.8 | 12.0 | 26.6 | 35.0 | 19.4 | 43.0 | 10.0 |
| February | 27.1 | 33.8 | 22.0 | 42.6 | 11.4 | 26.8 | 33.0 | 20.4 | 39.2 | 12.0 |
| March | 26.0 | 32.8 | 21.4 | 39.2 | 11.0 | 25.5 | 33.2 | 19.0 | 39.6 | 13.8 |
| April | 22.0 | 27.6 | 17.6 | 38.2 | 5.8 | 21.0 | 28.2 | 15.7 | 35.7 | 6.2 |
| May | 19.3 | 25.2 | 15.3 | 34.6 | 1.0 | 18.0 | 23.4 | 12.0 | 31.8 | 0.8 |
| June | 17.6 | 22.9 | 14.3 | 32.2 | 0.6 | 17.0 | 21.5 | 11.3 | 28.8 | —0.9 |
| July | 18.5 | 23.6 | 14.5 | 33.6 | 2.4 | 16.7 | 21.7 | 11.6 | 30.8 | 0.6 |
| August | 19.0 | 24.3 | 14.1 | 38.0 | 1.4 | 16.6 | 22.6 | 11.0 | 34.1 | 0.2 |
| September | 21.0 | 27.3 | 16.3 | 39.2 | 3.0 | 19.9 | 26.7 | 13.9 | 35.5 | 2.1 |
| October | 22.9 | 29.1 | 17.7 | 41.0 | 5.0 | 21.3 | 28.1 | 14.9 | 38.2 | 2.8 |
| November | 24.8 | 31.0 | 19.7 | 41.0 | 9.2 | 23.9 | 31.2 | 17.3 | 40.0 | 8.3 |
| December | 26.8 | 33.0 | 21.0 | 41.5 | 8.2 | 25.5 | 32.5 | 19.3 | 41.5 | 9.3 |
| Year | 22.7 | 28.7 | 18.0 | 42.6 | 0.6 | 21.6 | 28.1 | 15.5 | 43.0 | —0.9 |
| | Corrientes | | | | | Ceres | | | | |
| January | 26.6 | 34.1 | 21.3 | 42.8 | 12.0 | 25.5 | 34.7 | 17.7 | 46.0 | 6.5 |
| February | 26.8 | 33.7 | 21.5 | 42.0 | 10.0 | 24.8 | 33.7 | 17.9 | 45.5 | 3.2 |
| March | 25.4 | 32.2 | 20.8 | 39.9 | 10.5 | 22.0 | 31.2 | 16.4 | 40.2 | 4 0 |
| April | 20.7 | 26.7 | 16.6 | 38.5 | 8.0 | 18.8 | 26.8 | 12.7 | 37.6 | 1.5 |
| May | 17.5 | 23.4 | 13.9 | 32.8 | 0.7 | 15.8 | 23.6 | 10.1 | 36.5 | —4.5 |
| June | 16.0 | 21.4 | 12.1 | 31.8 | 0.5 | 13.1 | 20.4 | 7.4 | 31.5 | —6.0 |
| July | 16.2 | 22.2 | 12.1 | 37.5 | 1.5 | 12.9 | 20.6 | 6.4 | 34.0 | —6.0 |
| August | 15.9 | 22.5 | 11.1 | 34.0 | 1.0 | 12.9 | 21.2 | 5.7 | 38.0 | —7.0 |
| September | 18.8 | 25.9 | 13.7 | 38.9 | 1.5 | 17.2 | 25.9 | 9.2 | 44.0 | —3.0 |
| October | 21.0 | 28.2 | 15.2 | 40.7 | 4.0 | 19.2 | 28.0 | 11.7 | 42.0 | —2.0 |
| November | 23.3 | 30.4 | 17.7 | 41.3 | 9.5 | 21.7 | 30.6 | 14.3 | 43.6 | 4.0 |
| December | 25.7 | 32.9 | 20.2 | 42.8 | 10.5 | 24.4 | 32.9 | 16.7 | 45.0 | 6.5 |
| Year | 21.2 | 27.8 | 16.4 | 42.8 | 0.5 | 19.0 | 27.5 | 12.2 | 46.0 | —7.0 |
| | Paso de los Libres | | | | | Las Delicias | | | | |
| January | 26.1 | 33.4 | 18.5 | 43.5 | 9.8 | 23.2 | 31.9 | 16.9 | 41.8 | 9.0 |
| February | 26.8 | 35.4 | 19.5 | 45.6 | 10.1 | 23.4 | 32.1 | 17.6 | 41.2 | 5.4 |
| March | 24.4 | 32.6 | 18.9 | 41.8 | 8.2 | 21.7 | 29.8 | 16.7 | 39.9 | 7.4 |
| April | 19.3 | 26.3 | 14.3 | 36.5 | 4.6 | 17.4 | 24.7 | 12.6 | 35.8 | 3.0 |
| May | 16.2 | 22.3 | 11.4 | 32.2 | —0.9 | 14.7 | 21.5 | 9.8 | 32.8 | 0.6 |
| June | 14.4 | 20.1 | 10.0 | 29.5 | —1.0 | 13.0 | 18.6 | 7.4 | 29.0 | —4.0 |
| July | 14.4 | 20.6 | 10.1 | 30.4 | —0.6 | 11.5 | 17.8 | 6.8 | 29.4 | —2.6 |
| August | 13.8 | 20.8 | 8.8 | 32.5 | 0.4 | 11.5 | 18.8 | 5.7 | 31.4 | —3.0 |
| September | 17.3 | 24.8 | 12.3 | 34.1 | 0.2 | 14.9 | 22.5 | 9.4 | 39.2 | —1.8 |
| October | 19.3 | 27.1 | 13.3 | 39.7 | 3.4 | 17.3 | 24.3 | 11.3 | 39.8 | —2.1 |
| November | 22.2 | 30.6 | 16.0 | 39.4 | 8.2 | 19.8 | 27.5 | 13.6 | 39.6 | 4.6 |
| December | 24.6 | 32.7 | 17.6 | 44.2 | 9.9 | 23.2 | 30.1 | 16.0 | 40.2 | 8.8 |
| Year | 19.9 | 27.2 | 14.2 | 45.6 | —1.0 | 17.6 | 25.0 | 12.0 | 41.8 | —4.0 |

ANNUAL VARIATION OF TEMPERATURE IN THE LITTORAL.

| MONTH | Buenos Aires | | | | | Trenque Lauquen | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | Mean Max. | Mean Min. | Absol. Max. | Absol. Min. | Mean | Mean Max. | Mean Min. | Absol. Max. | Absol. Min. |
| | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° |
| January | 23.1 | 29.2 | 17.6 | 37.0 | 6.1 | 23.3 | 30.8 | 14.1 | 42.2 | 3.2 |
| February | 22 8 | 29.2 | 17.2 | 39.5 | 7.6 | 21.9 | 29.3 | 13.3 | 39.8 | 0.6 |
| March | 20.9 | 27.1 | 16.7 | 35.0 | 4.2 | 19.5 | 27.7 | 12.2 | 36.0 | 2.2 |
| April | 16.6 | 22.2 | 12.2 | 36.0 | 1.7 | 15.2 | 12.2 | 10.0 | 30.6 | — 1.7 |
| May | 13.3 | 17.6 | 8.2 | 29.5 | —4.0 | 12.1 | 18.0 | 5.7 | 30.1 | — 6.0 |
| June | 10.6 | 13.7 | 5.7 | 25.0 | —5.0 | 8.9 | 14.0 | 2.5 | 24.6 | —10.3 |
| July | 10.1 | 13.9 | 5.8 | 24.3 | —3.4 | 8.6 | 14.4 | 2.5 | 26.1 | — 6.1 |
| August | 11.3 | 14.7 | 5.9 | 26.0 | —2.7 | 9.4 | 16.3 | 2.5 | 27.0 | — 6.5 |
| September | 13.4 | 16.7 | 7.7 | 29.9 | —1.0 | 13.0 | 19.5 | 5.9 | 34.4 | — 3.9 |
| October | 16.1 | 20.7 | 10.4 | 30.4 | —1.8 | 15.3 | 22.9 | 8.3 | 34.4 | — 6.0 |
| November | 19.6 | 24.1 | 12.9 | 35.2 | 3.0 | 19.0 | 26.0 | 11.4 | 39.5 | 1.0 |
| December | 21.9 | 27.8 | 14.8 | 37.8 | 7.3 | 21.8 | 29.2 | 14.0 | 37.6 | 4.3 |
| Year | 16.6 | 21.4 | 11.3 | 39.5 | —5.0 | 15.7 | 22.5 | 8.5 | 42.2 | — 10.3 |
| | Azul | | | | | Mar del Plata | | | | |
| January | 21.9 | 29.9 | 13.3 | 40.0 | 2.5 | 19.6 | 25.5 | 14.2 | 35.0 | 4.1 |
| February | 20.9 | 28.6 | 13.1 | 38.3 | 3.0 | 18.9 | 25.9 | 13.9 | 39.5 | 4.1 |
| March | 18.3 | 26.4 | 11.9 | 35.6 | 2.1 | 17.7 | 24.0 | 13.6 | 34.5 | 4.5 |
| April | 14.3 | 21.7 | 8.7 | 29.0 | —2.0 | 15.2 | 19.8 | 10.9 | 29.0 | 0.5 |
| May | 10.6 | 16.9 | 5.4 | 25.5 | —7.0 | 12.0 | 15.9 | 6.6 | 24.0 | —1.0 |
| June | 8.0 | 13.2 | 3.8 | 24.5 | —7.0 | 9.2 | 11.9 | 4.7 | 20.0 | —5.4 |
| July | 7.4 | 13.2 | 2.6 | 22.0 | —6.0 | 8.5 | 11.7 | 4.3 | 20.8 | —2.0 |
| August | 8.0 | 13.9 | 2.5 | 23.4 | —6.0 | 7.9 | 12.4 | 4.7 | 21.5 | —1.0 |
| September | 11.2 | 17.8 | 5.1 | 29.7 | —4.0 | 10.2 | 14.7 | 6.2 | 29.0 | 0.0 |
| October | 13.8 | 21.1 | 7.2 | 32.3 | —3.4 | 11.7 | 16.8 | 8.1 | 27.6 | 0.6 |
| November | 17.1 | 24.8 | 10.0 | 33.6 | 0.0 | 14.8 | 20.9 | 10.5 | 32.0 | 1.5 |
| December | 19.9 | 27.0 | 11.5 | 36.0 | 2.0 | 17.4 | 23.1 | 11.5 | 35.4 | 4.8 |
| Year | 14.3 | 21.2 | 7.9 | 40.0 | —7.0 | 13.6 | 18.6 | 9.1 | 39.5 | —5.4 |
| | Bahia Blanca | | | | | Patagones | | | | |
| January | 21.5 | 30.2 | 15.3 | 40.0 | 3.0 | 23.5 | 30.8 | 16.0 | 41.2 | 5.5 |
| February | 21.0 | 28.5 | 15.0 | 41.0 | 7.0 | 21.7 | 28.0 | 14.5 | 42.5 | 2.0 |
| March | 18.9 | 26.1 | 13.3 | 38.6 | 7.0 | 19.7 | 26.4 | 13.2 | 40.0 | 4.0 |
| April | 15.2 | 21.3 | 10.5 | 32.1 | 1.0 | 15.7 | 22.1 | 9.6 | 32.0 | —1.0 |
| May | 11.2 | 16.1 | 7.1 | 25.7 | —1.0 | 11.9 | 17.7 | 6.4 | 29.5 | —2.0 |
| June | 7.7 | 12.1 | 4.5 | 24.0 | —5.2 | 8.6 | 13.5 | 4.3 | 24.5 | —8.0 |
| July | 7.5 | 11.8 | 3.7 | 24.0 | —4.0 | 8.4 | 13.9 | 3.4 | 26.0 | —6.0 |
| August | 8.5 | 14.0 | 3.8 | 27.8 | —2.2 | 8.8 | 15.0 | 3.4 | 29.0 | —8.0 |
| September | 11.4 | 16.9 | 6.3 | 30.0 | —0.7 | 12.1 | 18.7 | 6.2 | 32.5 | —5.0 |
| October | 13.9 | 21.0 | 8.4 | 35.0 | 0.0 | 14.8 | 21.6 | 7.8 | 35.5 | —3.0 |
| November | 17.4 | 25.1 | 11.1 | 36.0 | 4.0 | 18.6 | 25.5 | 11.4 | 38.2 | 1.0 |
| December | 19.7 | 27.9 | 13.7 | 40.0 | 6.0 | 21.7 | 28.5 | 14.1 | 39.0 | 3.5 |
| Year | 14.5 | 20.9 | 9.4 | 41.0 | —5.2 | 15.5 | 21.8 | 9.2 | 42.5 | —8.0 |

The values of the mean temperature for seven of the stations which figure in the preceding tables, are graphically illustrated in Plate XXI. These curves show the general character of the annual variation in the different parts of the Littoral. In the north, the amplitude of the variation is less than in the south, and in the former region the curve is more rounded at the epochs of *maximum* and *minimum* than in the latter.

In the lowlands of the north, the temperature rarely descends to zero, but in the interior and western sections of the territory of Formosa, frosts are experienced in the months of May, June and July, and in rare cases until September, though in this latter month they are very light: the lowest temperature observed in this region is—5°. The same conditions obtain in Misiones; near the rivers frosts are practically unknown, while in the hilly section of the interior temperatures as low as—6° have been registered.

In the territory of the Chaco, the province of Corrientes and the northern part of Santa Fe, temperatures as low as—4° are observed on an average of two or three times from May to September. In the south of Santa Fe and in Entre Rios the number of frosts increases, in general, to five or six, and in exceptional years they occur in the month of October.

In the province of Buenos Aires, normally there are 10 to 12 days of temperature below zero in the northern section and from 20 to 25 in the southwest, the intensity varying from—7° in the coastal region to—11° in the west and southwest.

Throughout the province, temperatures as low as—5° are common in the three winter months, and in the western and central sections they occur in September and October nearly every year. The month of November is generally exempt from frosts; in the southwest, however, they are experienced at intervals of several years but are seldom severe enough to affect the growth of cereals.

The influence which the direction of the wind has upon the temperature is shown by the mean yearly values contained in the following table. It is worthy of note that the effect is greater in winter than in summer by 1° to 1°.5. These figures show that throughout the Littoral the north wind produces the highest temperatures, while the lowest prevail with the wind from the south and southwest. The mean difference between the influences of the north and south wind is 3° to 4°. It is understood that this value is the mean for the year and does not refer to the sudden falls of temperature which accompany and follow the change of the wind from north to south, when at times the temperature drops 20° or more in a short interval, or in other words when the heated air coming from the equatorial regions is replaced by the cold air brought by the south and southwest winds.

MEAN INFLUENCE OF THE WIND ON THE TEMPERATURE.

| | N. | NE. | E. | SE. | S. | SW. | W. | NW. |
|---|---|---|---|---|---|---|---|---|
| | ° | ° | ° | ° | ° | ° | ° | ° |
| Bahia Blanca.......... | +3. 4 | +2. 7 | +0. 6 | —1. 7 | —3. 2 | —2. 7 | —0. 2 | +1. 0 |
| Buenos Aires.......... | +1. 4 | +1. 4 | —0. 6 | —1. 1 | —1. 5 | —1. 2 | —0. 2 | +0. 9 |
| Rosario........ ......... | +2. 8 | +1. 3 | +0. 9 | 0. 0 | —1. 0 | —1. 5 | —1. 4 | +0. 7 |
| Corrientes............ . | +2. 3 | +1. 5 | +0. 7 | —0. 8 | —2. 0 | —1. 6 | —0. 9 | +0. 8 |
| Asuncion................ | +2. 0 | 0. 0 | —0. 6 | —0. 7 | —1. 6 | —1. 4 | 0. 0 | +2. 0 |

*Solar Radiation.*—The instruments used to measure the intensity of the solar rays are maximum thermometers with the bulb, containing the mercury, blackened and enclosed in a glass case from which the air has been exhausted. The bulb is blackened with a coat of lampblack which absorbs the larger part of the solar rays, while the vacuum around the bulb serves to retard the cooling by conduction, so that the temperature registered by the instrument, commonly known as the *solar thermometer*, is greater than that of the air. Comparing its reading with that of an ordinary maximum thermometer one may obtain a measure which represents approximately the relation between the solar intensity and the temperature of the air. The following table contains the results deduced from three stations: Asuncion, Rosario de Santa Fe and Buenos Aires, and show the monthly means of the radiation temperature, the excess of this over the mean *maxima* of the air, and finally the highest value registered by months, in the entire series of observations.

## Asuncion

| Month | Mean Maximum Solar Temperature | Excess over Air Maximum | Maximum Solar Temperature |
|---|---|---|---|
| January | 69.°4 | 35.°2 | 77.°2 |
| February | 69. 3 | 35. 5 | 78. 0 |
| March | 66. 0 | 33. 2 | 76. 6 |
| April | 59. 9 | 32. 3 | 72. 8 |
| May | 54. 6 | 29. 4 | 68. 8 |
| June | 50. 9 | 28. 0 | 59. 5 |
| July | 53. 1 | 29. 5 | 60. 8 |
| August | 54. 2 | 29. 9 | 68. 4 |
| September | 59. 0 | 31. 6 | 69. 6 |
| October | 63. 1 | 34. 0 | 73. 8 |
| November | 66. 1 | 35. 1 | 73. 5 |
| December | 68. 4 | 35. 3 | 76. 2 |
| Year | 61. 2 | 32. 5 | 78. 0 |
| **Rosario** | | | |
| January | 61. 7 | 30. 4 | 77. 4 |
| February | 60. 2 | 29. 2 | 71. 6 |
| March | 56. 3 | 26. 7 | 67. 7 |
| April | 47. 5 | 23. 0 | 64. 7 |
| May | 44. 2 | 18. 3 | 57. 8 |
| June | 39. 3 | 14. 7 | 56. 4 |
| July | 39. 9 | 16. 5 | 51. 4 |
| August | 45. 2 | 18. 1 | 61. 8 |
| September | 48. 6 | 20. 1 | 63. 0 |
| October | 56. 3 | 23. 5 | 68. 0 |
| November | 57. 4 | 26. 4 | 74. 3 |
| December | 58. 9 | 28. 6 | 72. 3 |
| Year | 51. 3 | 23. 0 | 77. 4 |
| **Buenos Aires** | | | |
| January | 62. 8 | 33. 6 | 71. 0 |
| February | 59. 4 | 30. 2 | 67. 9 |
| March | 54. 0 | 26. 9 | 64. 0 |
| April | 49. 3 | 27. 1 | 58. 6 |
| May | 41. 6 | 24. 0 | 51. 5 |
| June | 35. 2 | 21. 5 | 44. 3 |
| July | 35. 6 | 21. 7 | 46. 8 |
| August | 40. 9 | 26. 2 | 52. 4 |
| September | 46. 1 | 29. 4 | 57. 0 |
| October | 55. 1 | 34. 4 | 63. 5 |
| November | 58. 6 | 34. 5 | 71. 3 |
| December | 61. 9 | 34. 4 | 70. 3 |
| Year | 50. 0 | 28. 7 | 71. 3 |

*Ground Temperature.*—The discussion of the earth temperatures is confined to the observations made in Las Delicias and Buenos Aires, with thermometers placed at the surface and at depths of $0^{m}.10$, $0^{m}.20$, $0^{m}.50$, and in Buenos Aires, at $1^{m}.00$. The monthly values of the temperatures in the different installations follow in tabular form.

| MONTH | Las Delicias (Entre Rios) | | | | | Buenos Aires | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | DEPTH | | | | | DEPTH | | | | |
| | Surface | m. 0.10 | m. 0.20 | m. 0.30 | m. 0.50 | Surface | m. 0.10 | m. 0.20 | m. 0.30 | m. 0.50 | m. 1.00 |
| | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° |
| January | 25.4 | 24.3 | 24.3 | 24.4 | 24.3 | 24.2 | 22.9 | 22.5 | 22.5 | 22.5 | 21.5 |
| February | 25.9 | 25.2 | 25.3 | 25.4 | 25.6 | 24.5 | 22.9 | 22.8 | 22.9 | 22.9 | 22.2 |
| March | 22.5 | 22.3 | 22.7 | 23.2 | 23.7 | 21.8 | 21.4 | 21.5 | 21.8 | 22.1 | 21.9 |
| April | 17.9 | 18.3 | 19.2 | 19.8 | 20.8 | 17.2 | 17.5 | 18.0 | 18.6 | 19.5 | 20.4 |
| May | 14.1 | 14.5 | 15.2 | 16.4 | 17.1 | 12.4 | 12.9 | 13.5 | 14.2 | 15.3 | 17.0 |
| June | 11.2 | 11.6 | 12.3 | 12.9 | 13.9 | 10.8 | 11.3 | 11.7 | 12.2 | 13.1 | 14.7 |
| July | 11.1 | 11.5 | 12.0 | 12.4 | 13.1 | 9.8 | 10.1 | 10.3 | 10.7 | 11.2 | 12.7 |
| August | 11.7 | 11.7 | 12.1 | 12.6 | 13.2 | 10.4 | 10.4 | 10.6 | 10.9 | 11.5 | 12.5 |
| September | 14.8 | 14.0 | 14.1 | 14.2 | 14.5 | 12.7 | 12.3 | 12.3 | 12.4 | 12.7 | 13.0 |
| October | 17.5 | 16.9 | 16.9 | 17.0 | 17.1 | 16.5 | 15.3 | 15.1 | 14.0 | 15.0 | 14.6 |
| November | 20.6 | 19.6 | 18.8 | 19.3 | 19.7 | 19.4 | 18.1 | 17.9 | 17.9 | 17.8 | 16.8 |
| December | 23.2 | 22.1 | 22.3 | 22.4 | 22.4 | 21.9 | 20.7 | 20.5 | 20.6 | 20.0 | 19.5 |
| Year | 18.0 | 17.7 | 17.9 | 18.3 | 18.8 | 16.8 | 16.3 | 16.4 | 16.6 | 17.0 | 17.2 |

From these values it is seen there is little difference in the mean annual temperature to the depth observed, i. e., $1^{m}.00$. The amplitude of the annual variation decreases with the depth. The amplitudes resulting from the comparison of the February *maximum* with the July-August *minimum* are:

| | | Las Delicias | Buenos Aires |
|---|---|---|---|
| Surface | | 14.9 | 15.0 |
| Depth of | $0^{m}.10$ | 13.8 | 13.1 |
| » » | $0^{m}.20$ | 13.4 | 12.7 |
| » » | $0^{m}.30$ | 13.1 | 12.3 |
| » » | $0^{m}.50$ | 12.6 | 11.9 |
| » » | $1^{m}.00$ | — | 9.8 |

In the transmission of heat through the earth we find that, at a depth of $0^{m}.50$ the *maximum* is retarded some twelve days with respect to that at the surface and at $1^{m}.00$ about twelve days more. For the *minimum* at $0^{m}.50$ and $1^{m}.00$ the retardations are more marked, being 15 and 28 days respectively.

## ATMOSPHERIC HUMIDITY.

A.—*Relative Humidity.* There are marked differences in the degree of saturation of the air between the northern section of the Littoral region; the greatest satura-

tion is observed in the territories of Formosa, Misiones and the Chaco, the province of Corrientes and in the region of the estuary of the River Plate, while in the south of the province of Buenos Aires it is about 10 % less. The curves of the diurnal and annual variations are the inverse of those for the temperature, the epochs of greatest humidity corresponding to those of lowest temperature and *vice versa.* Thus, the greater the amplitude between the extremes of temperature, the greater the variation in the degree of saturation, that is, in the capacity of the air to absorb aqueous vapour. To illustrate the diurnal variation of the relative humidity, the annexed table shows the hourly values, expressed in percentages of saturation, grouped by seasons and the year, for Asuncion and Buenos Aires. The former station represents the conditions of the inland river basins and the latter those directly influenced by adjacent bodies of water. The corresponding curves appear in Plate XXII.

DIURNAL VARIATION OF RELATIVE HUMIDITY.

| HOUR | Asuncion | | | | | Buenos Aires | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Summer | Autumn | Winter | Spring | Year | Summer | Autumn | Winter | Spring | Year |
| | % | % | % | % | % | % | % | % | % | % |
| 1 a. m. | 84 | 85 | 79 | 76 | 81 | 78 | 84 | 88 | 80 | 83 |
| 2 | 85 | 86 | 80 | 78 | 82 | 78 | 85 | 88 | 81 | 83 |
| 3 | 86 | 87 | 81 | 79 | 84 | 79 | 86 | 89 | 82 | 84 |
| 4 | 87 | 88 | 82 | 80 | 84 | 80 | 86 | 89 | 82 | 84 |
| 5 | 88 | 89 | 82 | 81 | 85 | 80 | 86 | 89 | 83 | 85 |
| 6 | 87 | 90 | 83 | 80 | 85 | 80 | 87 | 90 | 82 | 85 |
| 7 | 80 | 85 | 81 | 73 | 80 | 77 | 86 | 90 | 80 | 83 |
| 8 | 73 | 75 | 74 | 65 | 72 | 73 | 84 | 89 | 76 | 80 |
| 9 | 67 | 68 | 66 | 60 | 65 | 69 | 80 | 86 | 72 | 77 |
| 10 | 62 | 64 | 62 | 56 | 61 | 65 | 76 | 82 | 69 | 73 |
| 11 | 59 | 60 | 58 | 54 | 58 | 63 | 73 | 79 | 66 | 70 |
| Noon | 57 | 58 | 56 | 51 | 56 | 61 | 71 | 77 | 64 | 68 |
| 1 p. m. | 56 | 57 | 54 | 50 | 54 | 59 | 69 | 76 | 63 | 67 |
| 2 | 56 | 57 | 53 | 49 | 54 | 58 | 68 | 76 | 62 | 66 |
| 3 | 56 | 57 | 53 | 49 | 54 | 59 | 68 | 77 | 62 | 66 |
| 4 | 57 | 59 | 55 | 51 | 55 | 60 | 70 | 78 | 64 | 68 |
| 5 | 59 | 65 | 61 | 54 | 60 | 63 | 73 | 80 | 66 | 71 |
| 6 | 65 | 73 | 68 | 59 | 66 | 66 | 77 | 82 | 70 | 74 |
| 7 | 73 | 78 | 72 | 66 | 72 | 70 | 79 | 84 | 73 | 77 |
| 8 | 77 | 79 | 73 | 68 | 74 | 73 | 81 | 85 | 75 | 79 |
| 9 | 78 | 80 | 74 | 70 | 76 | 75 | 83 | 86 | 77 | 80 |
| 10 | 80 | 81 | 76 | 72 | 77 | 76 | 83 | 86 | 78 | 81 |
| 11 | 81 | 82 | 77 | 73 | 78 | 77 | 84 | 87 | 79 | 82 |
| Midnight | 82 | 84 | 78 | 74 | 80 | 77 | 84 | 87 | 80 | 82 |
| Average... | 72 | 74 | 70 | 65 | 71 | 71 | 79 | 84 | 74 | 77 |

The amplitude of the diurnal variation is as follows:

| | Asuncion | Buenos Aires |
|---|---|---|
| | % | % |
| Summer | 32 | 22 |
| Autumn | 33 | 19 |
| Winter | 30 | 24 |
| Spring | 32 | 21 |
| Year | 32 | 18 |

The following table shows the monthly values of the humidity for the same twelve stations whose temperatures were given. The graphical representation of nine of the curves in Plate XXIII illustrates the differences in the annual variation of the degree of saturation in the different parts of the Littoral.

ANNUAL VARIATION OF RELATIVE HUMIDITY.

| MONTH | Asuncion (Paraguay) | Posadas (Misiones) | Corrientes | Paso de los Libres (Corrientes) | Ceres (Santa Fe) | Las Delicias (Entre Rios) |
|---|---|---|---|---|---|---|
| | % | % | % | % | % | % |
| January | 70 | 65 | 69 | 63 | 64 | 65 |
| February | 71 | 69 | 70 | 62 | 69 | 65 |
| March | 72 | 72 | 74 | 73 | 75 | 74 |
| April | 76 | 77 | 77 | 80 | 78 | 80 |
| May | 78 | 81 | 80 | 84 | 79 | 81 |
| June | 78 | 80 | 80 | 84 | 80 | 81 |
| July | 73 | 79 | 80 | 83 | 77 | 80 |
| August | 68 | 75 | 76 | 81 | 70 | 74 |
| September | 67 | 74 | 76 | 81 | 69 | 76 |
| October | 68 | 74 | 73 | 76 | 66 | 76 |
| November | 70 | 72 | 70 | 72 | 68 | 74 |
| December | 69 | 72 | 70 | 70 | 67 | 67 |
| Year | 72 | 74 | 75 | 76 | 72 | 74 |
| | Buenos Aires (Capital) | T. Lauquen (Buenos Aires) | Azul (Buenos Aires) | Mar del Plata (Buenos Aires) | Bahia Blanca (Buenos Aires) | Patagones (Buenos Aires) |
| | % | % | % | % | % | % |
| January | 69 | 62 | 62 | 72 | 55 | 53 |
| February | 72 | 67 | 67 | 70 | 61 | 58 |
| March | 76 | 73 | 74 | 78 | 65 | 59 |
| April | 78 | 77 | 79 | 75 | 70 | 67 |
| May | 84 | 79 | 81 | 77 | 74 | 70 |
| June | 87 | 82 | 83 | 80 | 79 | 76 |
| July | 84 | 80 | 81 | 82 | 72 | 73 |
| August | 80 | 74 | 76 | 80 | 73 | 69 |
| September | 77 | 71 | 73 | 80 | 65 | 60 |
| October | 73 | 67 | 71 | 80 | 63 | 58 |
| November | 70 | 67 | 69 | 76 | 58 | 53 |
| December | 71 | 62 | 64 | 71 | 53 | 51 |
| Year | 77 | 72 | 73 | 77 | 66 | 62 |

The influence which the direction of the wind exercises upon the atmospheric humidity varies according to the hypsometric and hydrometric conditions of the region. In general, the north wind is accompanied by a low degree of saturation, while those from the south and southwest tend to increase the humidity. The mean of the extreme influences, of these opposite winds, is from 8 to 10 %. On the Atlantic coast, the greatest humidity corresponds to the east wind, from the sea, and the least, to the west wind, from the land. The most marked fluctuations in the degree of saturation experienced, in short periods, are ordinarily due more to vertical than to horizontal movements, i. e. to the ascending current of heated, dry air, and the descending current of a lower temperature and higher humidity. These currents are set in motion by the difference of temperature between the air in the lower and upper layers. The increase in humidity at such times often reaches 60 to 70 % in a few hours. This phenomenon is observed on a larger scale in the Mediterranean and Andean regions than in the Littoral.

B.—*Vapour Pressure.* The pressure of aqueous vapour is expressed in millimetres of mercury referred to the barometric column, thus indicating the quantity of vapour contained in the atmosphere, or the absolute quantity since it does not vary with a change of temperature, but the capacity of the air to absorb and retain vapour depends directly upon the temperature, this capacity for the retention of moisture being about doubled with each increase of 11° of temperature. At the temperature of 0°, the air when saturated contains 4.84 grammes of vapour and if, when in this state, it receives an additional amount of vapour, the excess is precipitated and returns to the original liquid condition.

The following table gives the weight, in grammes, of a cubic metre of saturated air with the corresponding vapour pressure in millimetres for every 10° of temperature from—20° to + 40°.

| Temperature | Weight of Vapour per cubic metre | Vapour Pressure |
|---|---|---|
| ° | Grammes | mm. |
| —20 | 1.08 | 0.94 |
| —10 | 2.36 | 2.15 |
| 0 | 4.84 | 4.57 |
| +10 | 9.33 | 9.14 |
| +20 | 17.10 | 17.36 |
| +30 | 30.04 | 31.51 |
| +40 | 50.63 | 54.87 |

Normally, the variations of absolute humidity are the inverse of those of relative humidity, since the warmest hours of the day are, in general, those in which the aqueous vapour is near its *maximum* value and the relative humidity at its *minimum*. Likewise, in the annual variations, the epoch of greatest pressure corresponds to that of lowest percentage of saturation.

Considering the geographical distribution of the aqueous vapour, it is found that, other conditions being equal, the quantity increases towards the equatorial regions and diminishes with elevation above sea level. To show the diminution of

the vapour pressure from the north of the Littoral southward, it is sufficient to cite the mean values for Asuncion in latitude 25°, Buenos Aires in 35° and Patagones in 41°. These are respectively 14.7 mm., 11.6 mm. and 7.5 mm.

In the diurnal variation of vapour pressure there are, in general, two *maxima* and two *minima*. The principal *minimum* occurs between 4 and 8 a. m. and the secondary some twelve hours later, or between 3 and 6 p. m. Of the two *maxima*, the first appears from 10 a. m. to 2 p. m. and the second between 7 and 10 p. m.; normally the first is the more pronounced. In the Atlantic coast region the secondary *minimum* is at times nearly eliminated, appearing only as a slight depression in the curve between the two *maxima*, especially during the winter months. The following table shows the hourly values for Asuncion and Buenos Aires, grouped by seasons. From these and their curves, in Plate XXIV, the characteristics of the variation of the vapour pressure in this region will be seen.

DIURNAL VARIATION OF VAPOUR PRESSURE.

| | Asuncion | | | | | Buenos Aires | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Hour | Summer | Autumn | Winter | Spring | Year | Summer | Autumn | Winter | Spring | Year |
| 1 a. m. | 18.3 | 14.7 | 10.8 | 13.1 | 14.2 | 14.8 | 12.1 | 8.3 | 10.4 | 11.4 |
| 2 | 18.2 | 14.7 | 10.8 | 13.0 | 14.2 | 14.7 | 12.0 | 8.2 | 10.3 | 11.3 |
| 3 | 18.1 | 14.6 | 10.7 | 12.9 | 14.1 | 14.5 | 11.8 | 8.1 | 10.1 | 11.1 |
| 4 | 18.0 | 14.5 | 10.6 | 12.9 | 14.0 | 14.3 | 11.7 | 8.0 | 10.0 | 11.0 |
| 5 | 17.9 | 14.5 | 10.5 | 12.8 | 13.9 | 14.3 | 11.6 | 8.0 | 10.0 | 10.9 |
| 6 | 18.1 | 14.5 | 10.4 | 12.9 | 14.0 | 14.5 | 11.5 | 7.9 | 10.0 | 11.0 |
| 7 | 18.6 | 14.7 | 10.4 | 13.1 | 14.2 | 14.8 | 11.7 | 7.9 | 10.2 | 11.2 |
| 8 | 18.7 | 15.0 | 10.6 | 13.2 | 14.4 | 15.0 | 11.9 | 8.0 | 10.4 | 11.3 |
| 9 | 19.0 | 15.2 | 10.9 | 13.5 | 14.6 | 15.2 | 12.1 | 8.2 | 10.6 | 11.5 |
| 10 | 19.1 | 15.4 | 11.0 | 13.7 | 14.8 | 15.3 | 12.3 | 8.3 | 10.6 | 11.6 |
| 11 | 19.3 | 15.5 | 11.2 | 13.8 | 15.0 | 15.5 | 12.5 | 8.5 | 10.7 | 11.8 |
| Noon | 19.3 | 15.5 | 11.3 | 13.9 | 15.0 | 15.5 | 12.6 | 8.6 | 10.8 | 11.9 |
| 1 p. m. | 19.3 | 15.5 | 11.4 | 13.8 | 15.0 | 15.5 | 12.7 | 8.7 | 10.8 | 11.9 |
| 2 | 19.3 | 15.5 | 11.5 | 13.9 | 15.0 | 15.3 | 12.7 | 8.8 | 10.7 | 11.9 |
| 3 | 19.0 | 15.2 | 11.3 | 13.7 | 14.8 | 15.3 | 12.7 | 8.8 | 10.6 | 11 8 |
| 4 | 18.8 | 15.1 | 11.2 | 13.6 | 14.7 | 15.4 | 12.7 | 8.9 | 10.6 | 11.9 |
| 5 | 18.6 | 15.2 | 11.2 | 13.5 | 14.6 | 15.4 | 12.7 | 8.9 | 10.7 | 11.9 |
| 6 | 18.9 | 15.4 | 11.3 | 13.5 | 14.8 | 15.5 | 12.9 | 8.9 | 10.9 | 12.0 |
| 7 | 19.1 | 15.4 | 11.2 | 13.6 | 14.8 | 15.7 | 12.9 | 8.8 | 11.0 | 12.1 |
| 8 | 19.0 | 15.2 | 11.2 | 13.6 | 14.7 | 15.8 | 12.8 | 8.7 | 11.0 | 12.1 |
| 9 | 18.8 | 15.1 | 11.2 | 13.5 | 14.6 | 15.8 | 12.8 | 8.6 | 10.9 | 12.0 |
| 10 | 18.7 | 15.0 | 11.1 | 13.4 | 14.5 | 15.6 | 12.6 | 8.5 | 10.8 | 11.9 |
| 11 | 18.6 | 14.8 | 11.0 | 13.3 | 14.4 | 15.4 | 12.4 | 8.4 | 10.7 | 11.7 |
| Midnight | 18.4 | 14.7 | 10.9 | 13.2 | 14.3 | 15.1 | 12.2 | 8.4 | 10.6 | 11.6 |
| Average...... | 18.7 | 15.0 | 11.0 | 13.4 | 14.5 | 15.2 | 12.3 | 8.4 | 10.5 | 11.6 |

The annual variation of the vapour pressure shows a curve the reverse of that of the relative humidity, and resembling that of the temperature. In the following table are the mean monthly vapour pressures for the same twelve stations whose relative humidity has been given; the values are derived from the same series of observations.

ANNUAL VARIATION OF VAPOUR PRESSURE.

| MONTH | Asuncion | Posadas | Corrientes | Paso de los Libres | Las Delicias | Ceres |
|---|---|---|---|---|---|---|
| January | 17.9 | 16.4 | 17.4 | 15.1 | 14.1 | 15.3 |
| February | 18.2 | 17.3 | 17.8 | 15.4 | 14.5 | 15.7 |
| March | 17.5 | 17.6 | 17.5 | 16.7 | 14.6 | 15.7 |
| April | 15.0 | 14.6 | 14.2 | 13.7 | 12.2 | 12.9 |
| May | 13.3 | 12.3 | 12.4 | 12.0 | 10.3 | 11.0 |
| June | 11.9 | 11.4 | 11.2 | 10.8 | 9.1 | 9.4 |
| July | 11.7 | 11.1 | 11.3 | 10.6 | 8.2 | 8.8 |
| August | 11.3 | 10.6 | 10.6 | 10.1 | 7.6 | 7.9 |
| September | 12.2 | 13.2 | 12.4 | 12.3 | 9.9 | 10.0 |
| October | 14.0 | 14.0 | 13.3 | 13.1 | 11.4 | 11.0 |
| November | 16.0 | 15.9 | 14.9 | 14.6 | 12.9 | 13.1 |
| December | 17.4 | 17.1 | 16.9 | 15.7 | 13.3 | 14.9 |
| Year | 14.7 | 14.3 | 14.2 | 13.3 | 11.5 | 12.1 |

| | Buenos Aires | Mar del Plata | Azul | Trenque Lauquen | Bahia Blanca | Patagones |
|---|---|---|---|---|---|---|
| January | 15.2 | 12.5 | 11.7 | 12.9 | 11.7 | 9.8 |
| February | 15.8 | 11.7 | 12.1 | 13.4 | 11.6 | 9.7 |
| March | 14.5 | 12.7 | 12.0 | 13.1 | 11.1 | 9.4 |
| April | 11.9 | 10.1 | 10.0 | 10.4 | 9.2 | 8.7 |
| May | 10.6 | 8.0 | 8.1 | 8.5 | 7.7 | 7.1 |
| June | 8.8 | 6.9 | 7.2 | 7.1 | 6.7 | 6.0 |
| July | 8.4 | 6.6 | 6.5 | 6.7 | 6.1 | 5.8 |
| August | 8.1 | 6.7 | 6.1 | 6.4 | 6.1 | 5.7 |
| September | 9.3 | 7.6 | 7.5 | 7.7 | 6.8 | 5.8 |
| October | 10.2 | 8.5 | 8.6 | 8.8 | 7.9 | 6.5 |
| November | 12.2 | 9.8 | 10.1 | 10.9 | 9.1 | 7.5 |
| December | 14.5 | 10.7 | 10.8 | 11.6 | 10.2 | 8.2 |
| Year | 11.6 | 9.3 | 9.2 | 9.8 | 8.7 | 7.5 |

The graphical representation for five of these stations shows the curve of the annual variations, as well as the decrease of the mean quantity of vapour with increase of latitude.

The relation between the vapour pressure and the wind direction is shown by the values deduced for four stations; these values represent the deviations from the mean annual vapour pressure corresponding to each of the eight principal wind directions.

| | N. | NE. | E. | SE. | S. | SW. | W. | NW. |
|---|---|---|---|---|---|---|---|---|
| Asuncion.......... | +1.9 | +1.3 | —0.2 | —1.7 | —2.2 | —1.0 | +0.7 | +1.2 |
| Corrientes......... | +2.3 | +0.5 | —0.5 | —1.3 | —1.7 | —0.1 | —0.2 | +1.0 |
| Rosario............ | +1.2 | +1.0 | +0.6 | +0.2 | —1.0 | —1.8 | —0.8 | +0.6 |
| Buenos Aires.... | +1.7 | +1.5 | —1.2 | —0.0 | —1.3 | —1.5 | —1.5 | —0.1 |

## STATE OF THE SKY.

A.—*Sunshine.* To show the degree of sunshine it is sufficient to give the results of two long series of observations made in Rosario de Santa Fe and in the Federal Capital, as these stations give the general features of the normal state of the sky in the Littoral.

The table below contains the mean monthly number of hours of sunshine registered, together with the percentage of the actual hours observed to the possible number of hours of sunshine.

| MONTH | ROSARIO | | BUENOS AIRES | |
|---|---|---|---|---|
| | Latitude 32° 57' | | Latitude 34° 37' | |
| | Number of hours registered | Relation between the hours registered and the possible | Number of hours registered | Relation between the hours registered and the possible |
| | | % | | % |
| January.......................... | 284 | 66 | 284 | 64 |
| February........................ | 250 | 68 | 238 | 64 |
| March............................ | 250 | 66 | 233 | 62 |
| April.............................. | 216 | 65 | 204 | 63 |
| May............................... | 174 | 55 | 153 | 51 |
| June............................... | 131 | 44 | 106 | 59 |
| July............................... | 147 | 47 | 118 | 40 |
| August........................... | 180 | 54 | 160 | 45 |
| September...................... | 212 | 60 | 180 | 53 |
| October......................... | 243 | 61 | 212 | 54 |
| November...................... | 260 | 63 | 244 | 61 |
| December....................... | 275 | 63 | 264 | 59 |
| Year.......... | 2,622 | 59 | 2,396 | 55 |

Combined by seasons we have the proportion of light registered to the light possible, which show the difference in the state of the sky according to the season of the year.

| | Rosario | Buenos Aires |
|---|---|---|
| Summer...................... | 66 % | 62 % |
| Autumn...................... | 62 » | 59 » |
| Winter ...................... | 48 » | 41 » |
| Spring....................... | 61 » | 56 » |

In Buenos Aires we find the cloudiness is 50 % more in winter than in summer. The mean of hours of sunshine per day, in each month, is as follows:—

| Month | Rosario | Buenos Aires |
|---|---|---|
| January | 9.1 | 9.1 |
| February | 9.0 | 8.4 |
| March | 8.2 | 7.6 |
| April | 7.2 | 7.0 |
| May | 5.5 | 5.1 |
| June | 4.5 | 3.8 |
| July | 4.5 | 3.9 |
| August | 6.0 | 4.9 |
| September | 7.0 | 6.3 |
| October | 7.7 | 6.5 |
| November | 8.2 | 8.1 |
| December | 8.7 | 8.5 |
| Year | 7.2 | 6.8 |

B.—*Cloudiness.* We will pass now to the consideration of the degree of cloudiness—the complement of the sunshine—determined by estimating the proportion of the sky covered.

The results presented in the next table are obtained from observations made three times a day at 7 a. m., 2 p. m., and 9 p. m. previous to the year 1903, and since then at 8 a. m., 2. p. m. and 8 p. m., according to a scale of 10, a completely clear sky being indicated by 0 and entirely clouded by 10. It is evident that the accuracy of this system depends on the ability of the observer to estimate the proportion of the sky covered, but experience has shown that, using a scale of 10, the observations are sufficiently accurate for general purposes.

In the Littoral region the cloudiness is much greater than in the interior, decreasing steadily as one leaves the coast. The curve of the diurnal variation has, in general, two *maxima* and two *minima.* In this region the principal *maximum* occurs two or three hours before sunset and the secondary two or three hours after sunrise. The predominating cloud type in the former is *cumulus* and in the latter, *stratus.* The first *minimum* occurs between an hour before and an hour after the sun's passage over the meridian, and the other from 9. p. m. to 12 p. m. The former is the principal *minimum* of the day.

The mean values for twelve stations, expressed in percentages, follow:

ANNUAL VARIATION OF THE AMOUNT OF CLOUD.

| MONTH | Asuncion | Posadas | Corrientes | Ceres | Las Delicias | Rosario |
|---|---|---|---|---|---|---|
| January | 41 | 42 | 37 | 41 | 42 | 45 |
| February | 44 | 56 | 44 | 40 | 42 | 42 |
| March | 42 | 54 | 42 | 43 | 47 | 44 |
| April | 46 | 50 | 44 | 45 | 45 | 44 |
| May | 43 | 51 | 49 | 48 | 54 | 41 |
| June | 49 | 52 | 48 | 54 | 59 | 53 |
| July | 45 | 56 | 46 | 48 | 53 | 48 |
| August | 47 | 54 | 44 | 44 | 45 | 46 |
| September | 46 | 52 | 45 | 44 | 51 | 44 |
| October | 47 | 52 | 48 | 48 | 50 | 48 |
| November | 47 | 48 | 47 | 44 | 44 | 43 |
| December | 43 | 50 | 47 | 41 | 44 | 43 |
| Year | 45 | 51 | 45 | 45 | 48 | 45 |
| | Buenos Aires | Mar del Plata | Trenque Lauquen | Azul | Bahia Blanca | Patagones |
| January | 40 | 45 | 42 | 48 | 37 | 41 |
| February | 42 | 39 | 44 | 48 | 37 | 40 |
| March | 40 | 39 | 43 | 45 | 37 | 40 |
| April | 40 | 47 | 49 | 47 | 41 | 48 |
| May | 51 | 51 | 61 | 56 | 49 | 56 |
| June | 58 | 57 | 65 | 59 | 58 | 57 |
| July | 50 | 51 | 56 | 51 | 51 | 52 |
| August | 48 | 54 | 42 | 48 | 49 | 48 |
| September | 47 | 50 | 50 | 47 | 45 | 48 |
| October | 53 | 52 | 48 | 48 | 45 | 47 |
| November | 45 | 51 | 48 | 46 | 42 | 46 |
| December | 41 | 50 | 44 | 47 | 38 | 41 |
| Year | 46 | 49 | 49 | 49 | 44 | 47 |

## RAIN.

This climatic element exerts such a great influence on the yield of the soil and differs so much in its cyclical and annual, as well as in its geographical features, that, to show its distribution, it is necessary to have data from a much larger number of stations than required for the discussion of the other elements. Consequently we give, in the following tables, the mean monthly rainfall for 33 places uniformly distributed over the Littoral region. All of these series are long enough to give values which may be considered as normals. The latitude, longitude (west of Greenwich) and the period of observations are given.

MEAN MONTHLY RAINFALL.

| | Mission Station Parag. Chaco | Asuncion (Paraguay) | Formosa | Posadas (Misiones) | C. de la Sierra (Misiones) | Corrientes (Capital) |
|---|---|---|---|---|---|---|
| Latitude........ | 23°23' | 25°18' | 26°12' | 27°19' | 27°58' | 27°28' |
| Longitude..... | 58°23' | 57°40' | 58°6' | 55°50' | 55°6' | 58°50' |
| Period ......... | 1896 to 1907 | 1892 to 1907 | 1879 to 1907 | 1902 to 1907 | 1902 to 1907 | 1876 to 1907 |
| | mm. | mm. | mm. | mm. | mm. | mm. |
| January...... | 116 | 170 | 146 | 80 | 119 | 145 |
| February.... | 80 | 146 | 183 | 90 | 88 | 125 |
| March........ | 84 | 132 | 157 | 126 | 112 | 135 |
| April ......... | 117 | 130 | 126 | 143 | 123 | 135 |
| May........... | 53 | 102 | 81 | 122 | 125 | 89 |
| June.......... | 56 | 65 | 77 | 125 | 177 | 82 |
| July........... | 45 | 55 | 44 | 119 | 119 | 41 |
| August....... | 21 | 48 | 32 | 144 | 155 | 40 |
| September.. | 57 | 78 | 84 | 109 | 133 | 69 |
| October...... | 107 | 137 | 155 | 221 | 242 | 118 |
| November.. | 122 | 156 | 158 | 129 | 143 | 130 |
| December... | 141 | 154 | 171 | 157 | 109 | 123 |
| Year... | 999 | 1,373 | 1,414 | 1,565 | 1,645 | 1,232 |

| | Itá Ibaté (Corrientes) | Santo Tomé (Corrientes) | Mercedes (Corrientes) | Goya | Paso de los Libres (Corrientes) | Mte. Caseros (Corrientes) |
|---|---|---|---|---|---|---|
| Latitude........ | 27°24' | 28°33' | 29°11' | 29°9' | 29°42' | 30°14' |
| Longitude..... | 57°28' | 55°38' | 58°7' | 59°16' | 57°7' | 57°38' |
| Period.......... | 1902 to 1907 | 1902 to 1907 | 1901 to 1907 | 1876 to 1907 | 1896 to 1907 | 1893 to 1907 |
| | mm. | mm. | mm. | mm. | mm. | mm. |
| January...... | 39 | 72 | 108 | 120 | 78 | 68 |
| February.... | 104 | 86 | 129 | 100 | 137 | 97 |
| March........ | 140 | 179 | 129 | 126 | 164 | 105 |
| April ......... | 94 | 123 | 185 | 96 | 144 | 97 |
| May .......... | 96 | 100 | 67 | 64 | 118 | 80 |
| June.......... | 86 | 158 | 65 | 36 | 92 | 64 |
| July........... | 99 | 131 | 67 | 42 | 86 | 63 |
| August ...... | 76 | 136 | 57 | 34 | 139 | 85 |
| September.. | 94 | 129 | 96 | 57 | 145 | 94 |
| October...... | 210 | 214 | 208 | 119 | 237 | 124 |
| November... | 147 | 136 | 132 | 102 | 119 | 101 |
| December.... | 173 | 123 | 99 | 108 | 172 | 115 |
| Year...... | 1,358 | 1,587 | 1,342 | 1,004 | 1,631 | 1,093 |

MEAN MONTHLY RAINFALL.

| | Esquina (Corrientes) | Ceres (Santa Fe) | Santa Fe (Capital) | Rosario (Santa Fe) | La Paz (Entre Rios) | Concordia (Entre Rios) |
|---|---|---|---|---|---|---|
| Latitude..... | 30°2' | 29°58' | 31°40' | 32°57' | 30°44' | 31°23' |
| Longitude.. | 59°25' | 61°50' | 60°42' | 60°38' | 59°37' | 58°4' |
| Period........ | 1895 to 1907 | 1896 to 1907 | 1895 to 1907 | 1895 to 1907 | 1902 to 1907 | 1887 to 1907 |
| | mm. | mm. | mm. | mm. | mm. | mm. |
| January..... | 83 | 115 | 83 | 95 | 60 | 91 |
| February... | 64 | 117 | 90 | 81 | 107 | 102 |
| March....... | 157 | 115 | 129 | 134 | 205 | 136 |
| April ........ | 117 | 81 | 85 | 79 | 102 | 123 |
| May.......... | 64 | 28 | 45 | 45 | 43 | 68 |
| June ......... | 29 | 11 | 23 | 37 | 28 | 61 |
| July.......... | 40 | 14 | 26 | 26 | 45 | 70 |
| August ..... | 50 | 22 | 22 | 38 | 40 | 56 |
| September . | 54 | 29 | 48 | 41 | 45 | 75 |
| October..... | 114 | 65 | 87 | 88 | 117 | 97 |
| November . | 88 | 89 | 86 | 87 | 95 | 78 |
| December .. | 98 | 107 | 116 | 134 | 108 | 116 |
| Year...... | 958 | 793 | 840 | 885 | 995 | 1,073 |

| | Villaguay (Entre Rios) | San Nicolas (Buenos Aires) | Junin (Buenos Aires) | Buenos Aires (Capital) | Lobos (Buenos Aires) |
|---|---|---|---|---|---|
| Latitude..... | 31°50' | 33°19' | 34°33' | 34°37' | 35°8' |
| Longitude.. | 59°1' | 60°13' | 60°52' | 58°22' | 59°3' |
| Period........ | 1896 to 1907 | 1901 to 1907 | 1895 to 1907 | 1861 to 1907 | 1892 to 1907 |
| | mm. | mm. | mm. | mm. | mm. |
| January..... | 75 | 83 | 58 | 77 | 58 |
| February... | 83 | 77 | 72 | 64 | 72 |
| March....... | 121 | 126 | 113 | 118 | 118 |
| April .. ..... | 103 | 106 | 68 | 76 | 84 |
| May.......... | 50 | 43 | 35 | 72 | 49 |
| June ......... | 39 | 35 | 25 | 69 | 44 |
| July.......... | 75 | 23 | 22 | 55 | 40 |
| August ..... | 45 | 41 | 38 | 60 | 60 |
| September . | 86 | 67 | 41 | 77 | 56 |
| October..... | 113 | 116 | 62 | 92 | 80 |
| November.. | 91 | 105 | 83 | 71 | 96 |
| December .. | 127 | 70 | 83 | 99 | 89 |
| Year...... | 1,008 | 892 | 700 | 930 | 846 |

MEAN MONTHLY RAINFALL.

| | 9 de Julio | Trenq. Lauquen | Dolores | Azul | Guamini |
|---|---|---|---|---|---|
| Latitude........ | 35°27' | 35°59' | 36°18' | 36°45' | 36°1' |
| Longitude..... | 60°53' | 62°20' | 57°40' | 59°50' | 62°26' |
| Period.......... | 1897 to 1907 | 1897 to 1907 | 1889 to 1907 | 1888 to 1907 | 1899 to 1907 |
| | mm. | mm. | mm. | mm. | mm. |
| January,.... | 62 | 80 | 70 | 75 | 61 |
| February.... | 71 | 76 | 73 | 61 | 97 |
| March....... | 126 | 111 | 106 | 114 | 102 |
| April ........ | 67 | 68 | 60 | 56 | 70 |
| May.......... | 42 | 24 | 51 | 47 | 19 |
| June ......... | 35 | 34 | 60 | 40 | 18 |
| July.......... | 37 | 28 | 58 | 49 | 15 |
| August...... | 47 | 17 | 64 | 55 | 27 |
| September.. | 49 | 40 | 60 | 49 | 40 |
| October..... | 71 | 70 | 63 | 81 | 50 |
| November.. | 85 | 69 | 62 | 82 | 62 |
| December.. | 68 | 86 | 61 | 79 | 53 |
| Year... | 760 | 703 | 788 | 788 | 614 |

| | Tandil | Mar del Plata | Tres Arroyos | Bahia Blanca | Patagones |
|---|---|---|---|---|---|
| Latitude.,...... | 37°17' | 37°59' | 38°23' | 38°45' | 40°48' |
| Longitude..... | 59°8' | 57°33' | 60°13' | 62°11' | 62°58' |
| Period.......... | 1888 to 1907 | 1888 to 1907 | 1888 to 1907 | 1860-1883 1896-1907 | 1898 to 1907 |
| | mm. | mm. | mm. | mm. | mm. |
| January..... | 74 | 50 | 76 | 44 | 24 |
| February... | 57 | 60 | 47 | 54 | 13 |
| March....... | 110 | 76 | 87 | 69 | 30 |
| April......... | 57 | 67 | 70 | 54 | 37 |
| May.......... | 65 | 64 | 51 | 30 | 30 |
| June ......... | 55 | 44 | 45 | 27 | 23 |
| July.......... | 65 | 64 | 44 | 25 | 21 |
| August ..... | 51 | 53 | 39 | 28 | 21 |
| September.. | 49 | 44 | 38 | 39 | 20 |
| October..... | 72 | 54 | 60 | 56 | 29 |
| November.. | 66 | 50 | 55 | 56 | 19 |
| December.. | 69 | 64 | 56 | 48 | 43 |
| Year... | 790 | 690 | 668 | 530 | 310 |

From the preceding values it is seen that, in the geographical distribution of rainfall, the drainage basin of the Uruguay river receives more precipitation than that of the Parana, this difference amounting to 40 °/₀ in the province of Corrientes. Throughout the Littoral there is a regular diminution in the quantity from east to west, but it is less pronounced than from north to south.

The most rainy month in the Littoral is March. It should be noted that in the regions along the Uruguay and La Plata rivers the means for this month are large owing to the abnormal rains which fell in March, 1900. (1)

In the south of Buenos Aires there is a well-marked secondary *maximum* in the months of October and November. The increased rainfall at this season of the year is of incalculable value to agricultural interests over a large area, since it comes when most needed to strengthen the young crops, enabling them to withstand the approaching season of hot weather and little rain. From this is deduced a strong argument for late sowing of cereals, since by sowing in August or September, a great part of the damage to crops, occasioned by the heavy frosts occurring in the three preceding months, might be avoided. According to our observations, sowing at the time above indicated, will, as a rule, insure good harvests. Normally, in the north of the Littoral the month of August has the least rainfall. In Corrientes, Santa Fe and Entre Rios, July is in general the driest month, and in the province of Buenos Aires the months of June and July.

In regard to the diurnal distribution of frequency and amount of rainfall, the hourly observations made in Buenos Aires show two *maxima* and two *minima*. The first and most marked *maximum* is from 6 to 8 a. m., and the second from 3 to 5 p. m. The first of the two *minima* corresponds to the period between 10 p. m. and midnight, and the second to that between noon and 2 p. m.

As a long series of observations are of interest, we reproduce here the monthly rainfall for the Federal Capital since 1861, with only two months incomplete—May 1868 and July 1870. The annual amounts are graphically represented in Plate XXVI, which shows the great fluctuations in the cyclical change for this place.

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(1). In the Federal Capital 545 mm. were observed, i. e., five times the previous normal amount for that month, and only 2 mm. less than the total fall of 1893.

RAINFALL IN BUENOS AIRES DURING THE PERIOD 1861 TO 1907.

| MONTH | 1861 | 1862 | 1863 | 1864 | 1865 | 1866 | 1867 | 1868 | 1869 | 1870 |
|---|---|---|---|---|---|---|---|---|---|---|
| | mm. | mm. | mm. | mm. | mm. | mm. | mm. | mm. | mm. | mm. |
| January | 11 | 27 | 108 | 36 | 52 | 14 | 10 | 64 | 149 | 19 |
| February | 31 | 103 | 99 | 50 | 7 | 50 | 33 | 176 | 68 | 70 |
| March | 30 | 68 | 72 | 86 | 50 | 31 | 47 | 109 | 189 | 201 |
| April | 73 | 49 | 13 | 97 | 127 | 76 | 124 | 45 | 18 | 72 |
| May | 3 | 144 | 74 | 80 | 72 | 132 | 22 | (81) | 181 | 199 |
| June | 18 | 125 | 74 | 76 | 115 | 74 | 69 | 86 | 9 | 74 |
| July | 12 | 72 | 25 | 37 | 75 | 32 | 70 | 5 | 3 | (35) |
| August | 56 | 32 | 66 | 44 | 64 | 33 | 9 | 80 | 54 | 29 |
| September | 63 | 78 | 42 | 104 | 70 | 54 | 30 | 90 | 94 | 5 |
| October | 151 | 124 | 15 | 33 | 85 | 248 | 6 | 148 | 174 | 40 |
| November | 18 | 85 | 22 | 40 | 15 | 57 | 77 | 100 | 75 | 60 |
| December | 118 | 153 | 91 | 61 | 43 | 81 | 110 | 163 | 158 | 33 |
| Year | 584 | 1,060 | 701 | 744 | 775 | 882 | 607 | 1,147 | 1,172 | 837 |

| | 1871 | 1872 | 1873 | 1874 | 1875 | 1876 | 1877 | 1878 | 1879 | 1880 |
|---|---|---|---|---|---|---|---|---|---|---|
| | mm. | mm. | mm. | mm. | mm. | mm. | mm. | mm. | mm. | mm. |
| January | 24 | 96 | 115 | 51 | 49 | 157 | 29 | 200 | 12 | 122 |
| February | 97 | 88 | 137 | 80 | 110 | 56 | 32 | 47 | 54 | 41 |
| March | 150 | 136 | 150 | 57 | 29 | 76 | 115 | 289 | 69 | 92 |
| April | 64 | 52 | 31 | 57 | 118 | 50 | 116 | 65 | 79 | 29 |
| May | 15 | 26 | 5 | 26 | 157 | 38 | 211 | 65 | 46 | 136 |
| June | 138 | 14 | 56 | 91 | 17 | 118 | 37 | 63 | 138 | 101 |
| July | 23 | 62 | 5 | 69 | 0 | 25 | 166 | 46 | 13 | 72 |
| August | 37 | 50 | 6 | 94 | 16 | 122 | 26 | 91 | 27 | 21 |
| September | 35 | 49 | 45 | 113 | 126 | 33 | 13 | 78 | 12 | 44 |
| October | 82 | 39 | 40 | 245 | 58 | 68 | 57 | 24 | 61 | 90 |
| November | 16 | 51 | 107 | 47 | 118 | 124 | 42 | 98 | 79 | 52 |
| December | 70 | 115 | 82 | 30 | 141 | 50 | 150 | 64 | 41 | 101 |
| Year | 751 | 778 | 779 | 960 | 939 | 917 | 994 | 1,130 | 631 | 901 |

| | 1881 | 1882 | 1883 | 1884 | 1885 | 1886 | 1887 | 1888 | 1889 | 1890 |
|---|---|---|---|---|---|---|---|---|---|---|
| | mm. | mm. | mm. | mm. | mm. | mm. | mm. | mm. | mm. | mm. |
| January | 129 | 196 | 54 | 52 | 51 | 113 | 54 | 28 | 324 | 114 |
| February | 0 | 60 | 0 | 44 | 68 | 27 | 14 | 202 | 97 | 40 |
| March | 56 | 40 | 140 | 153 | 101 | 57 | 37 | 57 | 148 | 200 |
| April | 82 | 38 | 62 | 212 | 55 | 136 | 87 | 84 | 147 | 72 |
| May | 5 | 28 | 167 | 4 | 93 | 112 | 0 | 20 | 96 | 11 |
| June | 122 | 43 | 172 | 57 | 28 | 90 | 121 | 22 | 58 | 47 |
| July | 20 | 65 | 136 | 12 | 77 | 3 | 61 | 48 | 77 | 112 |
| August | 62 | 167 | 36 | 17 | 63 | 0 | 58 | 128 | 86 | 72 |
| September | 170 | 37 | 173 | 349 | 28 | 143 | 73 | 139 | 20 | 28 |
| October | 86 | 35 | 93 | 77 | 145 | 96 | 56 | 79 | 62 | 23 |
| November | 99 | 91 | 62 | 89 | 163 | 36 | 44 | 91 | 51 | 39 |
| December | 215 | 149 | 43 | 39 | 153 | 102 | 103 | 191 | 112 | 73 |
| Year | 1,046 | 949 | 1,138 | 1,105 | 1,025 | 915 | 708 | 1,089 | 1,278 | 831 |

RAINFALL IN BUENOS AIRES DURING THE PERIOD 1861 TO 1907.

| MONTH | 1891 | 1892 | 1893 | 1894 | 1895 | 1896 | 1897 | 1898 | 1899 | 1900 |
|---|---|---|---|---|---|---|---|---|---|---|
| | mm. | mm. | mm. | mm. | mm. | mm. | mm. | mm. | mm. | mm. |
| January | 37 | 68 | 71 | 60 | 78 | 95 | 59 | 98 | 56 | 69 |
| February | 60 | 100 | 40 | 13 | 17 | 30 | 54 | 127 | 64 | 148 |
| March | 158 | 161 | 57 | 115 | 227 | 46 | 78 | 102 | 169 | 545 |
| April | 63 | 37 | 27 | 14 | 25 | 43 | 120 | 91 | 109 | 21 |
| May | 90 | 40 | 18 | 51 | 72 | 29 | 108 | 60 | 139 | 186 |
| June | 90 | 16 | 26 | 13 | 125 | 40 | 43 | 91 | 9 | 131 |
| July | 124 | 32 | 80 | 70 | 66 | 79 | 22 | 32 | 64 | 174 |
| August | 140 | 43 | 44 | 65 | 81 | 38 | 15 | 47 | 118 | 143 |
| September | 47 | 21 | 54 | 45 | 160 | 94 | 123 | 41 | 22 | 235 |
| October | 71 | 72 | 53 | 200 | 272 | 87 | 29 | 60 | 115 | 182 |
| November | 22 | 57 | 72 | 147 | 134 | 56 | 52 | 103 | 104 | 119 |
| December | 52 | 54 | 5 | 88 | 197 | 122 | 150 | 155 | 51 | 72 |
| Year... | 954 | 701 | 547 | 881 | 1,454 | 759 | 853 | 1,007 | 1,020 | 2,025 |

| MONTH | 1901 | 1902 | 1903 | 1904 | 1905 | 1906 | 1907 |
|---|---|---|---|---|---|---|---|
| | mm. | mm. | mm. | mm. | mm. | mm. | mm. |
| January | 149 | 24 | 77 | 60 | 72 | 44 | 21 |
| February | 100 | 70 | 61 | 80 | 54 | 8 | 10 |
| March | 80 | 62 | 204 | 179 | 119 | 27 | 178 |
| April | 13 | 95 | 82 | 75 | 170 | 138 | 100 |
| May | 96 | 124 | 28 | 0 | 56 | 41 | 10 |
| June | 35 | 18 | 160 | 57 | 21 | 67 | 65 |
| July | 15 | 29 | 50 | 58 | 79 | 104 | 30 |
| August | 39 | 4 | 146 | 50 | 53 | 93 | 48 |
| September | 89 | 53 | 109 | 25 | 52 | 58 | 47 |
| October | 126 | 84 | 12 | 87 | 246 | 62 | 53 |
| November | 73 | 94 | 19 | 95 | 46 | 61 | 44 |
| December | 75 | 162 | 96 | 25 | 118 | 114 | 78 |
| Year... | 890 | 819 | 1,044 | 791 | 1,086 | 817 | 684 |

The mean number of rainy days in the Littoral is as follows, counting as rainy days those when 1 mm. or more of precipitation fell.

| MONTH | Misiones and Formosa | Corrientes, Entre Rios and Santa Fe | Section North of Buenos Aires | Section South of Buenos Aires |
|---|---|---|---|---|
| January | 10 | 6 | 5 | 4 |
| February | 9 | 5 | 5 | 5 |
| March | 7 | 5 | 7 | 5 |
| April | 6 | 5 | 7 | 5 |
| May | 6 | 4 | 4 | 4 |
| June | 5 | 4 | 4 | 3 |
| July | 4 | 3 | 5 | 2 |
| August | 4 | 3 | 5 | 3 |
| September | 6 | 4 | 6 | 5 |
| October | 8 | 5 | 6 | 7 |
| November | 7 | 5 | 6 | 6 |
| December | 8 | 6 | 6 | 5 |
| Year | 80 | 55 | 66 | 54 |

*Thunderstorms.*—The distribution of electrical discharges bears an intimate relation to that of rain, as but rarely is lightning observed unaccompanied by showers. In the Littoral, thunderstorms are most frequent in the neighbourhood of La Plata river, the number decreasing both to the north and to the south of this section, as may be seen by consulting the numbers given in the annexed table, which gives the mean number of thunderstorm days, in the ten-year period, for Asuncion, Buenos Aires and Bahia Blanca.

TOTAL MONTHLY NUMBER OF THUNDERSTORMS IN TEN YEARS.

| MONTH | Asuncion | Buenos Aires | Bahia Blanca |
|---|---|---|---|
| January | 33 | 75 | 21 |
| February | 35 | 55 | 20 |
| March | 27 | 45 | 17 |
| April | 15 | 30 | 12 |
| May | 20 | 30 | 6 |
| June | 13 | 30 | 2 |
| July | 13 | 25 | 4 |
| August | 22 | 30 | 5 |
| September | 22 | 37 | 6 |
| October | 48 | 43 | 18 |
| November | 40 | 47 | 19 |
| December | 33 | 58 | 33 |
| Year | 321 | 505 | 163 |

The direction of the approach of thunderstorms, for the three stations mentioned, in the scale of 100 storms a year, is as follows.

| | N. | NE. | E | SE. | S. | SW. | W. | NW. |
|---|---|---|---|---|---|---|---|---|
| Asuncion............ | 26 | 12 | 21 | 4 | 21 | 4 | 0 | 12 |
| Buenos Aires....... | 25 | 13 | 24 | 16 | 8 | 6 | 2 | 4 |
| Bahia Blanca....... | 27 | 6 | 5 | 17 | 7 | 4 | 9 | 25 |

The influence of electrical storms on the temperature is to cause an appreciable cooling. From a long series of comparisons between the temperature of the day preceding and following the thunderstorm, the amount of the decrease in temperature is shown in the following table.

INFLUENCE OF THUNDERSTORMS ON THE TEMPERATURE.

| | October to March | April to September | Year |
|---|---|---|---|
| Asuncion............... | —1.6° | —3.5° | —2.4° |
| Rosario.................. | —2.9 | —2.7 | —2.8 |
| Buenos Aires ......... | —1.5 | —2.3 | —1.8 |
| Bahia Blanca.......... | —2.6 | —2.1 | —2.0 |

*Hail.*—In the northern part of the Littoral the occurrence of this phenomenon is comparatively rare, since in Asuncion hail normally falls three times in two years. In the same latitude, on the eastern side of the Littoral, near the Upper Parana, the number is slightly increased, the mean being two per year. In Bahia Blanca, seven hailstorms have been recorded in the last ten years. The region of greatest frequency is the province of Santa Fe and the western part of Buenos Aires, where they occur three or four times a year. In general, the fall is of short duration and over a comparatively narrow belt. At times the width of the path is not more than one kilometre. The observations, in detail, are given in the following table, showing the number of times hail has fallen in the last ten years at different points in the Littoral region, thus illustrating the annual and geographical distribution.

| MONTH | Esquina (Corrientes) | Gualeguay (Entre Rios) | Santa Fe (Capital) | Ceres (Santa Fe) | Buenos Aires (Capital) |
|---|---|---|---|---|---|
| January......... | 2 | 1 | 4 | 1 | 2 |
| February....... | 1 | 0 | 2 | 2 | 1 |
| March........... | 0 | 0 | 2 | 1 | 2 |
| April............. | 0 | 1 | 2 | 0 | 2 |
| May.............. | 0 | 1 | 0 | 1 | 2 |
| June............. | 0 | 0 | 3 | 0 | 3 |
| July.............. | 3 | 2 | 2 | 3 | 1 |
| August.......... | 4 | 0 | 3 | 0 | 3 |
| September...... | 2 | 3 | 4 | 3 | 6 |
| October......... | 5 | 1 | 8 | 3 | 4 |
| November...... | 3 | 1 | 4 | 2 | 0 |
| December...... | 0 | 1 | 5 | 0 | 3 |
| Total 10 years | 20 | 11 | 39 | 16 | 29 |

| MONTH | 9 de Julio | Azul | Necochea | Trenque Lauquen | General Alvear |
|---|---|---|---|---|---|
| January......... | 1 | 3 | 1 | 4 | 1 |
| February....... | 1 | 1 | 1 | 2 | 2 |
| March..... ..... | 3 | 1 | 1 | 1 | 0 |
| April............. | 5 | 1 | 1 | 4 | 2 |
| May.............. | 2 | 0 | 2 | 0 | 0 |
| June............. | 2 | 3 | 5 | 0 | 0 |
| July.............. | 2 | 1 | 3 | 2 | 5 |
| August.......... | 4 | 5 | 1 | 0 | 2 |
| September..... | 4 | 4 | 9 | 2 | 4 |
| October......... | 4 | 5 | 2 | 4 | 1 |
| November...... | 0 | 7 | 0 | 2 | 7 |
| December...... | 6 | 5 | 8 | 13 | 4 |
| Total 10 years | 32 | 36 | 34 | 34 | 28 |

## WIND.

A.—*Frequency*. To illustrate the percentage of winds from different directions, the observations from four stations are given in the tables which follow. These stations are distributed so as to represent the greater part of the north to south extension of the Littoral. The values are deduced from the tri-daily observations, in the scale of 1000 observations a month, and the mean of these represent the annual frequency. The observations are arranged according to the eight principal directions with the number of calms added. The graphical representation of the windrose will be found in Plate XXVII.

RELATIVE MONTHLY FREQUENCY OF WINDS.

## Asuncion

| MONTH | N. | NE. | E. | SE. | S. | SW. | W. | NW. | Calm |
|---|---|---|---|---|---|---|---|---|---|
| January | 129 | 104 | 97 | 116 | 224 | 36 | 14 | 18 | 262 |
| February | 159 | 129 | 165 | 92 | 194 | 29 | 26 | 12 | 194 |
| March | 109 | 143 | 122 | 75 | 290 | 11 | 18 | 11 | 221 |
| April | 76 | 157 | 176 | 80 | 270 | 19 | 6 | 20 | 196 |
| May | 68 | 158 | 175 | 93 | 267 | 18 | 13 | 13 | 195 |
| June | 74 | 159 | 161 | 43 | 319 | 35 | 7 | 17 | 185 |
| July | 86 | 271 | 193 | 50 | 228 | 27 | 5 | 9 | 131 |
| August | 97 | 204 | 131 | 70 | 276 | 32 | 20 | 3 | 167 |
| September | 97 | 164 | 137 | 102 | 346 | 33 | 11 | 3 | 107 |
| October | 68 | 170 | 190 | 188 | 249 | 21 | 13 | 11 | 90 |
| November | 104 | 200 | 119 | 128 | 241 | 25 | 7 | 11 | 165 |
| December | 147 | 186 | 134 | 102 | 195 | 18 | 11 | 29 | 178 |
| Year | 101 | 171 | 150 | 95 | 258 | 25 | 13 | 13 | 174 |

## Rosario

| MONTH | N. | NE. | E. | SE. | S. | SW. | W. | NW. | Calm |
|---|---|---|---|---|---|---|---|---|---|
| January | 119 | 69 | 182 | 256 | 119 | 74 | 33 | 99 | 49 |
| February | 155 | 62 | 173 | 224 | 157 | 71 | 22 | 49 | 87 |
| March | 136 | 68 | 282 | 167 | 132 | 82 | 31 | 44 | 58 |
| April | 110 | 89 | 131 | 145 | 122 | 111 | 120 | 128 | 44 |
| May | 84 | 62 | 116 | 92 | 124 | 137 | 155 | 149 | 81 |
| June | 161 | 67 | 175 | 125 | 186 | 78 | 80 | 75 | 53 |
| July | 158 | 110 | 140 | 140 | 208 | 48 | 56 | 81 | 59 |
| August | 146 | 62 | 130 | 141 | 262 | 100 | 43 | 59 | 57 |
| September | 83 | 51 | 164 | 266 | 197 | 55 | 32 | 52 | 100 |
| October | 74 | 91 | 133 | 191 | 235 | 29 | 44 | 77 | 106 |
| November | 125 | 72 | 180 | 194 | 195 | 42 | 41 | 46 | 105 |
| December | 75 | 81 | 156 | 188 | 213 | 76 | 29 | 61 | 121 |
| Year | 119 | 74 | 165 | 177 | 179 | 75 | 57 | 77 | 77 |

RELATIVE MONTHLY FREQUENCY OF THE WINDS.

**Buenos Aires**

| MONTH | N. | NE. | E. | SE. | S. | SW. | W. | NW. | Calm |
|---|---|---|---|---|---|---|---|---|---|
| January | 152 | 200 | 269 | 107 | 109 | 75 | 48 | 40 | 0 |
| February | 142 | 212 | 291 | 90 | 99 | 78 | 45 | 43 | 0 |
| March | 157 | 208 | 250 | 101 | 118 | 80 | 48 | 36 | 2 |
| April | 177 | 167 | 190 | 80 | 118 | 114 | 94 | 57 | 3 |
| May | 195 | 142 | 130 | 62 | 112 | 122 | 132 | 103 | 2 |
| June | 184 | 118 | 118 | 72 | 114 | 142 | 138 | 111 | 3 |
| July | 204 | 139 | 156 | 76 | 115 | 116 | 113 | 81 | 3 |
| August | 148 | 191 | 189 | 89 | 118 | 112 | 96 | 56 | 1 |
| September | 104 | 180 | 242 | 111 | 130 | 113 | 75 | 44 | 1 |
| October | 100 | 171 | 282 | 114 | 136 | 104 | 60 | 32 | 1 |
| November | 129 | 201 | 249 | 101 | 117 | 88 | 68 | 47 | 0 |
| December | 157 | 191 | 257 | 87 | 111 | 85 | 59 | 52 | 1 |
| Year | 152 | 174 | 216 | 89 | 115 | 101 | 79 | 57 | 17 |

**Bahia Blanca**

| MONTH | N. | NE. | E. | SE. | S. | SW. | W. | NW. | Calm |
|---|---|---|---|---|---|---|---|---|---|
| January | 239 | 58 | 155 | 99 | 77 | 56 | 112 | 163 | 41 |
| February | 216 | 57 | 115 | 91 | 113 | 62 | 108 | 178 | 60 |
| March | 301 | 52 | 105 | 69 | 82 | 45 | 108 | 178 | 60 |
| April | 262 | 40 | 73 | 24 | 98 | 56 | 96 | 198 | 153 |
| May | 241 | 60 | 41 | 26 | 24 | 60 | 120 | 269 | 159 |
| June | 189 | 49 | 16 | 22 | 49 | 95 | 122 | 338 | 120 |
| July | 200 | 56 | 58 | 24 | 69 | 54 | 144 | 279 | 116 |
| August | 230 | 71 | 60 | 45 | 49 | 69 | 112 | 254 | 110 |
| September | 180 | 80 | 80 | 49 | 71 | 80 | 129 | 291 | 40 |
| October | 172 | 92 | 140 | 54 | 67 | 107 | 114 | 183 | 71 |
| November | 161 | 72 | 152 | 89 | 63 | 58 | 123 | 213 | 69 |
| December | 170 | 54 | 131 | 80 | 69 | 129 | 146 | 197 | 24 |
| Year | 213 | 62 | 94 | 56 | 69 | 73 | 120 | 228 | 85 |

The preceding figures show the seasonal variation in the frequency of the winds as well as the different character of the wind frequency between the northern and southern sections of the Littoral. In the former we see from the yearly values that southerly winds predominate over northerly ones and that westerly and northwesterly winds are rare; while in the latter, winds from these two directions are greatly in excess of those from the south. The presentation of a greater number of stations would have made apparent the fact that the variation in the relative frequency takes place regularly, obeying a physical law which controls this phenomenon.

The limits fixed for this chapter prohibit the full discussion of the diurnal

variation in direction, which would require numerous tables for its demonstration, so that it only remains to note that along the Atlantic coast during the summer months the mean wind direction is NE. in the morning, ESE. in the afternoon and E. at night, thus giving a mean diurnal amplitude of 50.° This continues through the warmest months and is due mostly to the interchange of land and sea breezes or «virazón»—the latter blowing from noon till after sunset. In the winter the movement is very different, the mean morning direction being NW., that of the afternoon NE. and that of the night ESE., with a mean amplitude of variation more than double that of summer.

B.—*Velocity.* In the horizontal movement of the wind we find marked differences between the northern and southern extremes of the Littoral, or in other words, an increase of velocity with latitude. This may be seen by the values presented in the annexed table of five stations chosen to show the characteristics of the wind force in the different sections of the Littoral. The observations from which these values have been deduced were made with Robinson anemometers, the instruments in each installation being given the freest exposure available.

VELOCITY OF THE WIND IN KILOMETRES PER HOUR.

| MONTH | Asuncion (Paraguay) | Santa Ana (Misiones) | Rosario (Santa Fe) | Buenos Aires (Capital) | Bahia Blanca (Buenos Aires) |
|---|---|---|---|---|---|
| | Kms. | Kms. | Kms. | Kms. | Kms. |
| January | 4.7 | 5.6 | 11.0 | 16.1 | 17.8 |
| February | 4.8 | 6.5 | 10.6 | 16.9 | 16.4 |
| March | 4.8 | 5.7 | 10.0 | 14.3 | 14.6 |
| April | 5.2 | 5.9 | 8.3 | 15.9 | 12.2 |
| May | 5.8 | 5.8 | 10.1 | 13.4 | 10.2 |
| June | 6.4 | 8.5 | 9.8 | 14.2 | 13.4 |
| July | 7.4 | 9.5 | 11.6 | 15.8 | 13.5 |
| August | 7.5 | 7.7 | 12.3 | 16.1 | 14.4 |
| September | 8.1 | 7.7 | 11.7 | 17.6 | 16.0 |
| October | 7.3 | 7.3 | 13.6 | 16.2 | 16.1 |
| November | 5.6 | 6.0 | 13.0 | 16.4 | 16.4 |
| December | 4.9 | 5.9 | 12.0 | 16.3 | 18.1 |
| Year | 6.0 | 6.8 | 11.2 | 15.8 | 14.9 |

The figures show clearly the different character of the wind velocity in the different parts of the Littoral, not only in regard to the mean force, which is greater in the province of Buenos Aires than in the northern regions, but also in regard to the annual variation, since in the latter section the strongest winds are those of winter and spring, while in the former the summer and autumn are the seasons of greatest velocity.

The diurnal variation of the velocity is shown by the presentation of the hourly values derived from the anemometer observations made in Buenos Aires. They are expressed in kilometres per hour and grouped by seasons.

DIURNAL VARIATION OF THE WIND VELOCITY IN BUENOS AIRES.

| Hour | Summer | Autumn | Winter | Spring | Year |
|---|---|---|---|---|---|
| | Kms. | Kms. | Kms. | Kms. | Kms. |
| 1 a. m. | 14.3 | 13.8 | 14.9 | 14.9 | 14.5 |
| 2 | 14.2 | 13.7 | 14.7 | 14.7 | 14.3 |
| 3 | 14.2 | 13.8 | 14.6 | 14.2 | 14.2 |
| 4 | 14.0 | 13.8 | 14.6 | 14.3 | 14.2 |
| 5 | 13.2 | 13.2 | 14.4 | 14.6 | 13.8 |
| 6 | 13.3 | 13.3 | 14.1 | 14.6 | 13.8 |
| 7 | 15.5 | 13.1 | 14.0 | 16.7 | 14.8 |
| 8 | 17.1 | 14.3 | 14.7 | 18.4 | 16.1 |
| 9 | 18.0 | 15.7 | 15.9 | 18.6 | 17.0 |
| 10 | 18.4 | 17.0 | 17.9 | 19.6 | 18.2 |
| 11 | 19.0 | 17.3 | 18.3 | 19.4 | 18.5 |
| Noon | 19.2 | 17.3 | 18.3 | 19.8 | 18.6 |
| 1 p. m. | 20.0 | 17.3 | 18.4 | 20.4 | 19.0 |
| 2 | 19.6 | 17.1 | 18.2 | 19.5 | 18.6 |
| 3 | 20.1 | 16.9 | 17.7 | 19.1 | 18.4 |
| 4 | 19.4 | 15.6 | 16.1 | 19.4 | 17.6 |
| 5 | 19.3 | 13.9 | 13.9 | 18.0 | 16.3 |
| 6 | 18.0 | 12.4 | 13.2 | 15.3 | 14.7 |
| 7 | 15.5 | 12.6 | 13.5 | 14.4 | 14.0 |
| 8 | 14.5 | 13.0 | 13.0 | 14.8 | 13.8 |
| 9 | 14.6 | 13.2 | 14.5 | 15.2 | 14.4 |
| 10 | 14.1 | 13.5 | 14.8 | 15.1 | 14.4 |
| 11 | 14.6 | 13.4 | 14.6 | 15.6 | 14.6 |
| Midnight....... | 14.6 | 13.5 | 14.5 | 14.8 | 14.4 |
| Average... | 16.4 | 14.5 | 15.4 | 16.7 | 15.8 |

From these results it may be seen that the velocity varies but little in the interval from an hour or two after sunset until sunrise; but from then on the increase is regular, and the curve, during the solar day, is approximately that of the diurnal temperature variation. The greatest divergence between these two curves is in the hour of the *maximum:* the velocity curve coinciding with the passage of the sun over the meridian, or about two hours before the epoch of highest temperature. The highest velocities registered in Buenos Aires in the last years with the Dines anemometer—which gives the velocity of gusts of momentary duration—are shown by the following monthly values, in kilometres per hour.

MAXIMUM VELOCITY.

| | Kms. | | Kms. |
|---|---|---|---|
| January........................ | 82 | July............................. | 62 |
| February......... ........... | 81 | Augus ........................ | 88 |
| March.......................... | 52 | September.................... | 91 |
| April .......................... | 86 | October ....................... | 75 |
| May............................. | 86 | November .................... | 63 |
| June ........................... | 84 | December..................... | 89 |

The strongest wind anemographically registered in the Littoral was felt at Fisherton, 10 kms. to the north of Rosario, during the dust storm which caused such damage in the south of Santa Fe and north of Buenos Aires on the 12th of January, 1894. At. 6.25 p.m. the force of the wind broke the wires which connected the anemometer with the registering apparatus. In the two minutes preceding the break the indicated velocity was 140 kilometres per hour.

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## MEDITERRANEAN ZONE.

This zone has the same northern and southern limits as the Littoral region, by which it is bounded on the east, its western boundary being the Andean zone. Thus it occupies a position between the low «fluvial» and coast region and that from which the foothills of the Andes rise. The zone includes the provinces of Santiago del Estero, Cordoba, San Luis and the eastern sections of Salta, Jujuy, Tucuman, Catamarca, La Rioja, Mendoza and the territory of the Pampa Central. Except for the Cordoba and San Luis sierras and the Aconquija range, the ground has, in general, a height of from 100 to 500 metres above sea level.

The sections of Salta, Jujuy, and Tucuman which lie in this region are well watered by the affluents of the Bermejo and Salado rivers, but in other parts the water supply is somewhat scarce. The rivers and streams which rise in the mountains of Cordoba and San Luis are small, in general, except for the floods of summer, which, though of short duration, at times cause considerable damage. The Carcaraña, formed by the junction of the Tercero and Saladillo rivers, is the only one which empties into the Parana. The others lose themselves in the sandy ground, generally at a short distance from their source, appearing as dry beds during the greater part of the year.

The mountains are the true wealth of this zone, showing their beneficent action by the interception of the aqueous vapour brought by the winds and its condensation, due to the cooling of the air as it rises to greater heights in passing over their summits. Thus they produce an increase of rainfall on the windward side with a corresponding scarcity on the leeward side, and, as the prevailing winds in this zone are from the northeast, the eastern slopes are more favoured with rain than the western.

The numerical data in the following tables show the climatic features of the Mediterranean zone. They are arranged in the same order as those given for the Littoral.

### ATMOSPHERIC PRESSURE.

The variations of the barometric pressure are so uniform throughout the length of the Mediterranean region that the data for a single place suffice to indicate the normal diurnal changes in this element for the whole region. For this reason only the mean values deduced from the long series of observations made in Cordoba are given. These hourly values, grouped by seasons, appear in the annexed table.

DIURNAL VARIATION OF THE ATMOSPHERIC PRESSURE IN CORDOBA.

(ALTITUDE—438 METRES)

| Hour | Summer | Autumn | Winter | Spring | Year |
|---|---|---|---|---|---|
| | mm. | mm. | mm. | mm. | mm. |
| 1 a. m. | 722.6 | 725.0 | 726.2 | 724.8 | 724.7 |
| 2 | 22.4 | 24.8 | 26.0 | 24.6 | 24.4 |
| 3 | 22.3 | 24.5 | 25.7 | 24.4 | 24.2 |
| 4 | 22.3 | 24.4 | 25.6 | 24.4 | 24.2 |
| 5 | 22.5 | 24.5 | 25.5 | 24.6 | 24.3 |
| 6 | 22.9 | 24.7 | 25.7 | 24.9 | 24.6 |
| 7 | 23.2 | 25.0 | 26.1 | 25.3 | 24.9 |
| 8 | 23.4 | 25.3 | 26.4 | 25.5 | 25.1 |
| 9 | 23.3 | 25.4 | 26.6 | 25.5 | 25.2 |
| 10 | 22.2 | 25.4 | 26.6 | 25.2 | 25.1 |
| 11 | 23.0 | 25.1 | 26.4 | 24.9 | 24.8 |
| Noon | 22.6 | 24.7 | 25.8 | 24.4 | 24.4 |
| 1 p. m. | 22.2 | 24.1 | 25.1 | 23.9 | 23.8 |
| 2 | 21.7 | 23.6 | 24.6 | 23.3 | 23.3 |
| 3 | 21.2 | 23.4 | 24.4 | 22.9 | 23.0 |
| 4 | 20.9 | 23.3 | 24.5 | 22.7 | 22.9 |
| 5 | 20.7 | 23.5 | 24.8 | 22.8 | 23.0 |
| 6 | 20.9 | 23.7 | 25.2 | 23.2 | 23.2 |
| 7 | 21.3 | 24.1 | 25.7 | 23.7 | 23.7 |
| 8 | 21.8 | 24.6 | 26.1 | 24.3 | 24.2 |
| 9 | 22.4 | 25.0 | 26.3 | 24.8 | 24.6 |
| 10 | 22.8 | 25.1 | 26.5 | 25.0 | 24.8 |
| 11 | 22.9 | 25.2 | 26.5 | 25.1 | 24.9 |
| Midnight | 22.8 | 25.1 | 26.4 | 25.0 | 24.8 |
| Average.... | 722.3 | 724.6 | 725.8 | 724.4 | 724.3 |

The hours at which the two *maxima* and the two *minima* normally occur are:—

| | MINIMUM I | | MAXIMUM I | | MINIMUM II | | MAXIMUM II | |
|---|---|---|---|---|---|---|---|---|
| | Hour A. M. | Pressure mm. | Hour A. M. | Pressure mm. | Hour P. M. | Pressure mm. | Hour P. M. | Pressure mm. |
| Summer.... | $3^h\ 10^m$ | 722.2 | $8^h\ 25^m$ | 723.4 | $5^h\ 10^m$ | 720.7 | $11^h\ 10^m$ | 722.9 |
| Autumn.... | 4 20 | 24.4 | 9 20 | 25.5 | 3 40 | 23.3 | 10 55 | 25.2 |
| Winter..... | 4 35 | 25.5 | 9 30 | 26.7 | 3 20 | 24.4 | 10 50 | 26.5 |
| Spring...... | 3 30 | 24.4 | 8 30 | 25.4 | 4 5 | 22.7 | 10 45 | 25.1 |
| Year... | 3 50 | 724.1 | 9 0 | 725.2 | 4 10 | 722.8 | 11 10 | 724.9 |

For the annual variation the mean monthly pressures are given for six places well distributed over the zone under consideration.

ANNUAL VARIATION OF THE ATMOSPHERIC PRESSURE.

| Month | Ingenio Esperanza (568 metres) | Tucuman (460 metres) | S. del Estero (201 metres) | Cordoba (438 metres) | San Luis (759 metres) | Gral. Acha (226 metres) |
|---|---|---|---|---|---|---|
| | mm. | mm. | mm. | mm. | mm. | mm. |
| January........ | 711.9 | 720.2 | 741.7 | 722.1 | 697.1 | 738.5 |
| February...... | 11.7 | 20.4 | 42.1 | 22.8 | 698.1 | 39.5 |
| March.......... | 12.6 | 21.3 | 43.7 | 23.4 | 698.8 | 39.9 |
| April............ | 14.6 | 23.1 | 45.5 | 25.0 | 698.7 | 41.4 |
| May.. .......... | 14.8 | 23.2 | 45.2 | 25.3 | 699.2 | 41.2 |
| June ............ | 15.0 | 23.6 | 45.8 | 25.8 | 698.6 | 42.1 |
| July ............. | 14.6 | 23.3 | 45.2 | 25.6 | 699.6 | 41.6 |
| August ......... | 15.4 | 24.4 | 46.4 | 25.9 | 700.1 | 43.3 |
| September.... | 14.4 | 23.2 | 45.1 | 25.8 | 698.8 | 42.8 |
| October......... | 13.0 | 22.1 | 43.8 | 24.4 | 698.6 | 41.3 |
| November...... | 11.9 | 20.6 | 42.1 | 22.9 | 697.4 | 39.0 |
| December..... | 11.5 | 19.8 | 41.1 | 22.0 | 697.6 | 38.1 |
| Year..... | 713.4 | 722.1 | 744.0 | 724.3 | 698.5 | 740.7 |

From the preceding figures it appears that the period of highest pressure falls in July and August, and the lowest in December and January, and that the amplitude of the variation decreases with increased elevation above sea level.

The influence exercised by the wind direction upon the height of the barometric column, or rather the relation between these two factors, may be seen in a general way from the following values, which give the amount of the departure of the atmospheric pressure from the annual normal for each of the eight principal wind directions.

BAROMETRIC WINDROSE.

| | N. | NE. | E. | SE. | S. | SW. | W. | NW. |
|---|---|---|---|---|---|---|---|---|
| | mm. | mm. | mm. | mm. | mm. | mm. | mm. | mm. |
| Tucuman... | —0.4 | —0.8 | —0.2 | +1.4 | +0.9 | 0.0 | —0.6 | —0.2 |
| S. del Estero | —2.3 | —1.7 | 0.0 | +1.7 | +1.4 | +1.1 | 0.0 | —0.2 |
| Cordoba..... | —1.5 | +0.2 | +1.0 | +1.6 | +1.3 | —0.1 | —1.0 | —1.5 |

TEMPERATURE.

Throughout the greater part of the Mediterranean zone the distribution of mean temperature depends on the influence of solar climate, since the isothermal maps show that from the eastern boundary almost across to the western the lines of equal temperature cross the zone in a direction parallel to latitude circles, but approaching the irregular ground of the Andean zone the lines bend to the north, forming right angles with their direction over the lower region. From this change of direction it becomes evident that the solar climate is now dominated by the

physical, produced by the Cordilleras. The deflection of the isotherms in the neighbourhood of the Cordoba and San Luis sierras indicate that the effect is similar to that produced by the higher chains of the Andes.

The mean annual temperature of this zone varies by 8°, that is between 23,° in the northwest of the province of Salta, and 15° in the south of the territory of the Pampa. In chart XIII we see that the region in which the highest temperatures have been observed—indicated by the isotherm of 46°—is in the province of Santiago del Estero and that the absolute *maxima* shown in the chart have an amplitude of only 3° in the whole region, the amplitude of variation of the absolute *minima* in the same region reaches 8°, the *minimum* in the north being 4° and in the Pampa—12° (see chart XIV). Thus the amplitude between the extremes in this zone is 58°.

The variations of temperature are more marked throughout the length of this zone than in the Littoral. Changes of over 30° sometimes occur within a few hours. Similarly the diurnal variation shows more widely separated extremes, due to the rapid radiation from the soil and the greater dryness of the air. As examples of the diurnal temperature variation the hourly values are given by seasons, for Tucuman and Cordoba, with their graphical representation in Plate XXVIII.

DIURNAL VARIATION OF THE TEMPERATURE IN THE MEDITERRANEAN ZONE.

| | Tucuman | | | | | Cordoba | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| HOUR | Summer | Autumn | Winter | Spring | Year | Summer | Autumn | Winter | Spring | Year |
| | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° |
| 1 a. m. | 21.1 | 16.5 | 9.4 | 16.6 | 15.9 | 18.4 | 13.3 | 7.2 | 13.2 | 13.0 |
| 2 | 20.7 | 16.2 | 9.1 | 16.2 | 15.6 | 17.9 | 12.9 | 6.8 | 12.7 | 12.6 |
| 3 | 20.3 | 16.0 | 8.8 | 15.7 | 15.2 | 17.4 | 12.5 | 6.5 | 12.2 | 12.2 |
| 4 | 20.0 | 15.7 | 8.4 | 15.3 | 14.8 | 17.0 | 12.1 | 6.2 | 11.8 | 11.8 |
| 5 | 19.6 | 15.4 | 8.1 | 14.9 | 14.5 | 16.7 | 11.8 | 5.9 | 11.5 | 11.5 |
| 6 | 19.6 | 15.2 | 7.8 | 14.8 | 14.4 | 17.2 | 11.6 | 5.6 | 11.8 | 11.5 |
| 7 | 20.8 | 15.3 | 7.8 | 16.3 | 15.0 | 19.4 | 12.1 | 5.7 | 13.9 | 12.8 |
| 8 | 22.5 | 16.9 | 9.7 | 18.6 | 16.9 | 22.0 | 14.6 | 7.4 | 16.6 | 15.2 |
| 9 | 24.4 | 18.6 | 12.6 | 20.8 | 19.1 | 23.9 | 17.3 | 10.6 | 18.8 | 17.6 |
| 10 | 25 9 | 20.1 | 14.7 | 22.6 | 20.8 | 25.4 | 19.4 | 13.2 | 20.4 | 19.6 |
| 11 | 27.3 | 21.6 | 16.7 | 24.4 | 22.5 | 26.5 | 20.9 | 15.2 | 21.7 | 21.1 |
| Noon | 28.4 | 22.7 | 18.2 | 25.8 | 23.8 | 27.4 | 22.0 | 16.5 | 22.7 | 22.1 |
| 1 p. m. | 29.2 | 23.5 | 19.3 | 26.7 | 24.7 | 28.0 | 22.6 | 17.4 | 23.4 | 22.8 |
| 2 | 29.4 | 23.7 | 19.5 | 26.7 | 24.8 | 28.4 | 23.0 | 17.8 | 23.8 | 23.2 |
| 3 | 29.3 | 23.5 | 19.4 | 26.4 | 24.6 | 28.4 | 22.8 | 17.7 | 23.7 | 23.2 |
| 4 | 28.8 | 22.9 | 18.7 | 25.8 | 24.0 | 28.1 | 22.1 | 16.9 | 23.2 | 22.6 |
| 5 | 27.8 | 21.7 | 16.9 | 24.5 | 22.7 | 27.4 | 20.8 | 15.3 | 22.2 | 21.4 |
| 6 | 26.4 | 20.0 | 14.4 | 22.8 | 20.9 | 26.1 | 19.0 | 13.2 | 20.5 | 19.7 |
| 7 | 24.7 | 18.8 | 12.6 | 20.8 | 19.2 | 24.3 | 17.4 | 11.5 | 18.7 | 18.0 |
| 8 | 23.6 | 18.2 | 11.7 | 19.6 | 18.3 | 22.6 | 16.2 | 10.2 | 17.2 | 16.6 |
| 9 | 22.8 | 17.7 | 11.0 | 18.8 | 17.5 | 21.2 | 15.2 | 9.3 | 16.0 | 15.4 |
| 10 | 22.3 | 17.3 | 10.4 | 18.1 | 17.0 | 20.2 | 14.6 | 8.7 | 15.1 | 14.7 |
| 11 | 21.9 | 16.9 | 10.0 | 17.6 | 16.6 | 19.5 | 14.0 | 8.1 | 14.5 | 14.0 |
| Midnight | 21.4 | 16.7 | 9.7 | 17.2 | 16.2 | 18.9 | 13.6 | 7.6 | 13.9 | 13.5 |
| Mean ....... | 24.1 | 18.8 | 12.7 | 20.3 | 19.0 | 22.6 | 16.7 | 10.9 | 17.5 | 16.9 |

As evidence of the annual variation in different sections of this zone the mean monthly temperature, referred to the true mean of the 24 hours and to the ten years from 1898 to 1907 inclusive, besides the mean *maximum* and mean *minimum* and the absolute extremes observed during the whole series of observations are given for ten stations.

ANNUAL VARIATION OF THE TEMPERATURE IN THE MEDITERRANEAN ZONE.

| MONTH | Tucuman | | | | | Santiago del Estero | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | Mean Max. | Mean Min. | Absol. Max. | Absol. Min. | Mean | Mean Max. | Mean Min. | Absol. Max. | Absol. Min. |
| | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° |
| January | 24.4 | 31.2 | 18.6 | 44.4 | 11.2 | 28.5 | 35.5 | 20.3 | 46.0 | 13.0 |
| February | 24.1 | 29.9 | 18.9 | 44.0 | 9.9 | 27.2 | 34.4 | 20.3 | 44.0 | 12.0 |
| March | 22.0 | 27.6 | 17.7 | 37.8 | 8.0 | 24.8 | 31.5 | 19.4 | 41.7 | 11.2 |
| April | 18.4 | 24.0 | 14.2 | 35.2 | 4.0 | 21.0 | 27.3 | 15.4 | 39.0 | 5.5 |
| May | 15.5 | 21.6 | 10.7 | 32.0 | 0.2 | 17.8 | 24.1 | 11.4 | 34.0 | —1.0 |
| June | 12.2 | 18.8 | 7.2 | 33.8 | —3.2 | 11.4 | 19.6 | 7.3 | 29.3 | —2.5 |
| July | 12.3 | 20.0 | 6.0 | 37.3 | —3.2 | 14.4 | 20.9 | 7.5 | 33.0 | —3.0 |
| August | 13.2 | 21.1 | 6.5 | 36.7 | —3.0 | 15.7 | 23.5 | 8.6 | 35.2 | —2.5 |
| September | 18.1 | 26.0 | 10.8 | 41.2 | —0.6 | 20.3 | 28.5 | 12.7 | 41.5 | 0.3 |
| October | 20.2 | 27.9 | 13.6 | 41.2 | 2.1 | 23.0 | 30.5 | 15.6 | 43.7 | 7.0 |
| November | 22.0 | 28.9 | 16.2 | 41.3 | 7.2 | 25.6 | 32.7 | 18.1 | 44.8 | 10.0 |
| December | 23.4 | 30.6 | 18.3 | 41.0 | 8.2 | 27.4 | 34.0 | 20.4 | 43.8 | 12.3 |
| Year | 18.8 | 25.6 | 13.2 | 44.4 | —3.2 | 21.7 | 28.5 | 14.8 | 46.0 | —3.0 |

| MONTH | Recreo (Catamarca) | | | | | Cruz del Eje (Cordoba) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | Mean Max. | Mean Min. | Absol. Max. | Absol. Min. | Mean | Mean Max. | Mean Min. | Absol. Max. | Absol. Min. |
| | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° |
| January | 27.8 | 34.5 | 19.4 | 42.2 | 9.4 | 25.0 | 33.2 | 17.4 | 39.6 | 9.0 |
| February | 26.8 | 33.6 | 18.5 | 42.9 | 13.0 | 25.5 | 32.8 | 17.5 | 41.8 | 8.5 |
| March | 24.5 | 30.9 | 18.3 | 41.1 | 5.5 | 22.7 | 30.8 | 16.0 | 39.4 | 2.6 |
| April | 20.6 | 26.6 | 14.7 | 40.6 | 2.0 | 18.7 | 27.4 | 13.0 | 39.0 | 2.5 |
| May | 17.3 | 23.4 | 10.4 | 39.4 | —2.2 | 16.0 | 24.3 | 9.6 | 33.0 | 0.0 |
| June | 13.6 | 20.0 | 6.6 | 28.9 | —6.2 | 12.8 | 20.2 | 4.8 | 30.5 | —5.0 |
| July | 13.4 | 19.9 | 5.6 | 32.4 | —5.4 | 12.4 | 21.1 | 5.5 | 34.0 | —7.0 |
| August | 15.0 | 22.4 | 6.6 | 32.3 | —3.8 | 13.2 | 22.7 | 6.5 | 31.5 | —2.2 |
| September | 20.0 | 27.4 | 12.0 | 43.2 | 0.0 | 18.0 | 27.1 | 9.9 | 35.8 | —2.0 |
| October | 22.5 | 30.0 | 14.8 | 43.0 | 5.0 | 20.0 | 26.9 | 12.4 | 39.0 | 1.0 |
| November | 25.0 | 31.3 | 17.5 | 43.7 | 8.2 | 22.4 | 30.4 | 14.4 | 39.6 | 5.5 |
| December | 27.3 | 33.6 | 19.3 | 43.3 | 12.2 | 24.1 | 31.4 | 16.2 | 40.4 | 9.0 |
| Year | 21.2 | 27.8 | 13.6 | 43.7 | —6.2 | 19.2 | 27.4 | 11.9 | 41.8 | —7.0 |

ANNUAL VARIATION OF THE TEMPERATURE IN THE MEDITERRANEAN ZONE.

| MONTH | Cordoba | | | | | Rio Cuarto (Cordoba) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | Mean Max. | Mean Min. | Absol. Max | Absol. Min. | Mean | Mean Max. | Mean Min. | Absol. Max. | Absol. Min. |
| | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° |
| January | 22.9 | 30.3 | 16.0 | 41.8 | 5.8 | 23.0 | 31.8 | 15.9 | 41.6 | 6.5 |
| February | 22.5 | 28.9 | 15.8 | 43.7 | 3.4 | 22.4 | 30.2 | 15.8 | 44.3 | 4.5 |
| March | 20.4 | 27.0 | 14.4 | 38.0 | 2.5 | 20.3 | 26.4 | 14.1 | 27.8 | 4.9 |
| April | 16.5 | 23.5 | 10.2 | 36.6 | —3.8 | 16.5 | 24.0 | 10.3 | 36.0 | 1.3 |
| May | 13.1 | 20.6 | 6.7 | 33.3 | —5.8 | 13.0 | 20.4 | 6.8 | 33.6 | —6.0 |
| June | 9.9 | 17.3 | 3.7 | 31.9 | —8.2 | 9.6 | 17.0 | 3.6 | 29.6 | —6.4 |
| July | 10.4 | 18.1 | 3.6 | 35.0 | —8.9 | 9.0 | 16.9 | 3.0 | 31.0 | —6.0 |
| August | 12.1 | 20.2 | 4.7 | 36.5 | —7.0 | 10.4 | 18.5 | 3.2 | 35.1 | —5.4 |
| September | 14.9 | 22.6 | 7.4 | 37.7 | —6.0 | 14.4 | 22.6 | 7.4 | 37.5 | —2.2 |
| October | 17.4 | 24.6 | 10.4 | 40.0 | —1.0 | 16.8 | 25.0 | 9.3 | 36.5 | —4.7 |
| November | 20.2 | 27.4 | 13.2 | 39.4 | 2.2 | 19.4 | 27.6 | 11.7 | 42.0 | 3.1 |
| December | 22.3 | 29.4 | 15.3 | 40.7 | 4.2 | 21.7 | 30.1 | 14.6 | 41.5 | 4.7 |
| Year | 16.9 | 24.2 | 10.1 | 43.7 | —8.9 | 16.4 | 24.2 | 9.6 | 44.3 | —6.4 |

| MONTH | Arias (Cordoba) | | | | | San Luis | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | Mean Max. | Mean Min. | Absol. Max. | Absol. Min. | Mean | Mean Max. | Mean Min. | Absol. Max. | Absol. Min. |
| | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° |
| January | 23.0 | 31.0 | 15.3 | 42.4 | 6.5 | 24.1 | 32.5 | 17.4 | 40.8 | 10.0 |
| February | 23.0 | 30.6 | 15.3 | 43.2 | 4.8 | 22.8 | 31.4 | 17.1 | 39.5 | 10.5 |
| March | 20.8 | 27.9 | 13.9 | 39.4 | 4.9 | 21.3 | 28.6 | 15.3 | 38.7 | 7.2 |
| April | 17.1 | 24.0 | 10.5 | 37.2 | —0.2 | 16.4 | 22.0 | 9.8 | 33.0 | 1.5 |
| May | 13.8 | 19.8 | 7.1 | 31.2 | —5.0 | 13.1 | 19.2 | 7.3 | 28.5 | —1.8 |
| June | 10.4 | 16.3 | 4.7 | 28.4 | —8.2 | 10.2 | 15.2 | 3.7 | 24.3 | —3.2 |
| July | 10.1 | 16.2 | 3.4 | 30.4 | —7.6 | 9.5 | 16.3 | 3.6 | 27.6 | —7.0 |
| August | 10.6 | 17.7 | 3.3 | 29.0 | —6.2 | 10.8 | 18.0 | 5.3 | 29.6 | —3.1 |
| September | 13.7 | 21.4 | 6.4 | 33.5 | —1.0 | 15.0 | 22.2 | 8.4 | 34.8 | —1.3 |
| October | 16.2 | 23.4 | 8.6 | 36.3 | —1.2 | 17.3 | 24.8 | 10.8 | 35.0 | 0.4 |
| November | 19.3 | 26.8 | 11.9 | 40.0 | 0.2 | 20.8 | 27.6 | 13.8 | 38.0 | 3.6 |
| December | 22.3 | 29.6 | 14.0 | 38.5 | 4.5 | 22.7 | 30.1 | 15.1 | 39.4 | 8.0 |
| Year | 16.7 | 23.7 | 9.5 | 43.2 | —8.2 | 17.0 | 24.0 | 10.6 | 40.8 | —7.0 |

ANNUAL VARIATION OF THE TEMPERATURE IN THE MEDITERRANEAN ZONE.

| MONTH | Victorica (Pampa) | | | | | General Uriburu (Pampa) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | Mean Max. | Mean Min. | Absol. Max. | Absol. Min. | Mean | Mean Max. | Mean Min. | Absol. Max. | Absol. Min. |
| | o | o | o | o | o | o | o | o | o | o |
| January | 23.9 | 33.4 | 14.5 | 44.8 | 6.0 | 22.6 | 31.0 | 13.8 | 42.3 | 4.7 |
| February | 21.9 | 31.8 | 14.0 | 42.2 | 1.5 | 21.6 | 29.1 | 13.0 | 39.9 | 0.1 |
| March | 18.5 | 28.9 | 12.8 | 38.9 | 3.6 | 18.8 | 27.4 | 12.3 | 34.4 | 1.9 |
| April | 14.7 | 23.4 | 8.1 | 34.7 | — 2.8 | 14.9 | 23.0 | 7.8 | 31.2 | —0.8 |
| May | 10.5 | 17.9 | 4.5 | 30.1 | — 6.0 | 10.7 | 18.6 | 4.2 | 30.1 | —5.2 |
| June | 7.5 | 13.6 | 0.5 | 23.8 | —11.0 | 7.2 | 13.4 | 1.8 | 21.2 | —7.4 |
| July | 7.2 | 14.6 | 0.5 | 24.0 | — 9.5 | 7.2 | 14.4 | 0.5 | 24.8 | —7.2 |
| August | 7.6 | 17.3 | 1.3 | 31.0 | — 8.0 | 8.0 | 16.6 | 1.5 | 27.7 | —6.9 |
| September | 11.6 | 19.5 | 4.3 | 33.9 | — 5.8 | 11.8 | 20.3 | 4.5 | 34.9 | —5.4 |
| October | 14.5 | 23.4 | 8.8 | 35.9 | — 0.8 | 14.7 | 22.6 | 6.9 | 35.2 | —2.1 |
| November | 18.8 | 29.0 | 10.8 | 42.8 | — 0.1 | 18.3 | 26.9 | 9.8 | 38.2 | —1.2 |
| December | 21.9 | 30.8 | 13.3 | 40.0 | 3.7 | 21.0 | 29.3 | 12.0 | 39.6 | 1.2 |
| Year | 14.9 | 23.6 | 7.8 | 44.8 | —11.0 | 14.7 | 22.7 | 7.3 | 42.3 | —7.4 |

The curves which represent graphically the annual variation for eight of the stations from the last tables appear in Plate XXIX.

The mean amplitude of the annual variation differs but slightly in the different parts of the Mediterranean zone, but the amplitude between the absolute extremes in the various parts is much less constant, as may be seen from the following figures.

| | Range of the mean annual variation of the temperature | Extreme variation |
|---|---|---|
| | o | o |
| Tucuman | 13.4 | 47.6 |
| Santiago del Estero | 13.8 | 49.0 |
| Recreo | 12.4 | 49.9 |
| Cruz del Eje | 15.4 | 49.1 |
| Cordoba | 14.1 | 52.9 |
| Rio Cuarto | 14.6 | 50.7 |
| Arias | 14.2 | 51.8 |
| San Luis | 13.4 | 47.8 |
| Victorica | 15.8 | 55.8 |
| General Uriburu | 15.4 | 49.7 |

The influence which the wind exercises on the temperature in the central region of the Republic is well shown by the values obtained from the long series of observations made in Santiago del Estero and in Cordoba. The results correspond to the four seasons and to the entire year and refer to the temperature rise or fall which as a rule accompanies a wind from each of the eight principal points of the compass.

Santiago del Estero

| | N. | NE. | E. | SE. | S. | SW. | W. | NW. |
|---|---|---|---|---|---|---|---|---|
| | ° | ° | ° | ° | ° | ° | ° | ° |
| Summer | +3.7 | +1.8 | +1.4 | —1.5 | —2.2 | —1.2 | —2.3 | +0.2 |
| Autumn | +1.8 | +1.2 | +0.2 | —0.6 | —1.6 | —0.5 | —2.2 | +1.7 |
| Winter | +2.3 | +0.4 | +0.7 | 0.0 | —0.8 | —0.1 | —2.2 | —0.3 |
| Spring | +3.1 | +1.6 | +0.6 | —2.2 | —2.0 | —0.8 | +0.2 | —0.6 |
| Year | +2.7 | +1.3 | +0.7 | —1.0 | —1.6 | —0.6 | —1.6 | +0.2 |

Cordoba

| | N. | NE. | E. | SE. | S. | SW. | W. | NW. |
|---|---|---|---|---|---|---|---|---|
| | ° | ° | ° | ° | ° | ° | ° | ° |
| Summer | +2.0 | +1.6 | +0.4 | —1.0 | —2.5 | —0.9 | —0.4 | +0.5 |
| Autumn | +2.0 | +0.2 | —0.3 | —0.4 | —1.8 | —0.6 | +0.1 | +0.9 |
| Winter | +2.6 | —0.3 | —1.2 | —1.3 | —2.0 | —0.4 | +0.6 | +1.8 |
| Spring | +2.3 | +0.7 | +0.2 | —1.5 | —1.1 | —0.4 | +0.2 | +0.6 |
| Year | +2.2 | +0.5 | —0.2 | —1.0 | —1.8 | —0.6 | +0.1 | +1.2 |

*Solar Radiation.*—In treating of this factor of the temperature, extracts are taken from long series of observations made in Cordoba since the year 1874, from Ingenio Esperanza (Province of Jujuy) in the period from 1896 to 1902, and the short series from Tucuman during the last two years. The black bulb thermometers employed were placed 25 cms. above the sod-covered soil and exposed on sunny days.

The thermometers are of the maximum type so that their readings represent the highest radiation temperature experienced during the day. The monthly means of these values for the three series of observations are given in the following table together with the *maximum* registered in each series.

| MONTH | Ingenio Esperanza | | Tucuman | | Cordoba | |
|---|---|---|---|---|---|---|
| | Mean maximum solar temperature | Absolute maximum | Mean maximum solar temperature | Absolute maximum | Mean maximum solar temperature | Absolute maximum |
| | ° | ° | ° | ° | ° | ° |
| January | 67.8 | 79.0 | 68.8 | 75.0 | 64.8 | 77.8 |
| February | 64.9 | 75.0 | 67.6 | 77.0 | 63.3 | 76.0 |
| March | 58.8 | 73.0 | 66.3 | 72.3 | 59.7 | 78.0 |
| April | 51.9 | 77.5 | 62.0 | 72.5 | 54.1 | 69.5 |
| May | 47.6 | 60.0 | 54.7 | 62.5 | 47.3 | 65.5 |
| June | 43.0 | 61.0 | 48.2 | 55.0 | 42.1 | 65.0 |
| July | 45.9 | 62.0 | 51.3 | 60.0 | 43.5 | 68.7 |
| August | 49.5 | 64.0 | 54.8 | 61.0 | 47.8 | 67.0 |
| September | 54.5 | 70.0 | 58.6 | 66.5 | 53.6 | 68.5 |
| October | 61.0 | 76.0 | 62.3 | 71.0 | 58.6 | 72.0 |
| November | 64.0 | 76.5 | 68.2 | 74.4 | 61.5 | 79.0 |
| December | 66.7 | 77.0 | 66.5 | 76.0 | 63.6 | 76.5 |
| Year | 56.4 | 79.0 | 60.8 | 77.0 | 55.0 | 79.0 |

For the comparison of the *maximum* values of the solar radiation with those of the air temperature, the Cordoba observations are employed, as the series is so long that the results may be considered as normals for the greater part of the Mediterranean zone.

EXCESS OF THE MEAN MAXIMUM SOLAR TEMPERATURE OVER THAT OF THE AIR.

| | | | |
|---|---|---|---|
| | ° | | ° |
| January | 34.5 | July | 25.4 |
| February | 34.3 | August | 27.6 |
| March | 32.7 | September | 31.0 |
| April | 30.6 | October | 34.0 |
| May | 26.7 | November | 34.1 |
| June | 24.8 | December | 34.2 |
| Year | 30.8 | | |

*Temperature of the Earth.*—The exposition of the earth temperatures in this zone are confined to the presentation of the results of 21 years of continuous observations in Cordoba, this place being characteristic of the thermal conditions in the upper layers of the soil for the larger part of the interior of the Republic. The observations were made at the surface and at depths of $0^{m}.10$, $0^{m}.25$, $0^{m}.50$, $1^{m}.20$, $1^{m}.70$ and $3^{m}.75$. In the following summary the monthly values depend on the readings taken at 8 a. m. and 6 p. m.

ANNUAL VARIATION OF THE EARTH TEMPERATURE.

| MONTH | At the surface | DEPTH | | | | | |
|---|---|---|---|---|---|---|---|
| | | 0m.10 | 0m.25 | 0m.50 | 1m.20 | 1m.70 | 3m.75 |
| | ° | ° | ° | ° | ° | ° | ° |
| January | 22.8 | 21.7 | 21.6 | 21.4 | 20.4 | 19.6 | 18.0 |
| February | 22.2 | 21.6 | 21.6 | 21.6 | 21.0 | 20.3 | 18.6 |
| March | 19.9 | 19.8 | 20.0 | 20.4 | 20.6 | 20.4 | 19.0 |
| April | 16.0 | 16.3 | 16.9 | 17.9 | 19.4 | 19.7 | 19.3 |
| May | 12.2 | 13.0 | 13.9 | 15.3 | 17.6 | 18.4 | 19.4 |
| June | 9.0 | 9.9 | 10.7 | 12.4 | 15.4 | 16.8 | 19.1 |
| July | 9.4 | 10.0 | 10.6 | 11.7 | 14.2 | 15.3 | 18.6 |
| August | 10.9 | 11.1 | 11.4 | 12.1 | 13.7 | 14.7 | 17.8 |
| September | 14.2 | 13.8 | 13.7 | 13.7 | 14.2 | 14.8 | 17.4 |
| October | 17.1 | 16.3 | 16.1 | 15.9 | 15.6 | 15.6 | 17.1 |
| November | 19.9 | 18.8 | 18.4 | 18.0 | 17.1 | 16.8 | 17.1 |
| December | 22.1 | 21.0 | 20.7 | 20.3 | 19.0 | 18.3 | 17.4 |
| Year | 16.3 | 16.1 | 16.3 | 16.7 | 17.4 | 17.6 | 18.2 |

The curves traced from the preceding figures are shown in Plate XXX. From them may be seen the decrease in the amplitude of the variation and also the lagging of the dates of *maxima* and *minima* with increased depths.

The calculated dates for the extreme temperature in each of the observed layers are as follows:—

| DEPTH | MAXIMA | | MINIMA | | Amplitude |
|---|---|---|---|---|---|
| | Temperature | Date | Temperature | Date | |
| metres | ° | | ° | | ° |
| 0.00 | 22.8 | January ... 15 | 8.9 | June .......... 30 | 13.9 |
| 0.10 | 21.8 | » ..... 17 | 9.8 | » .......... 30 | 12.0 |
| 0.25 | 21.8 | » ...... 25 | 10.5 | July .......... 5 | 11.3 |
| 0.50 | 21.6 | February.. 1 | 11.7 | » .......... 19 | 9.9 |
| 1.20 | 21.1 | » .... 25 | 13.7 | August........ 16 | 7.4 |
| 1.70 | 20.4 | March ...... 2 | 14.6 | » .......... 28 | 5.8 |
| 3.75 | 19.4 | May......... 10 | 17.1 | November.... 1 | 2.3 |

It is seen by the dates at which the extreme temperatures occur that the propagation of summer heat from the surface downwards is more rapid than the cooling or loss of heat by conduction. For example, at the depth of 3m.75 the *maximum* temperature occurs 85 days later than that of the surface (January 15 to May 10), and the *minimum*, 124 days after that of the surface (June 30 to November 1). Basing a calculation on these figures, it appears that, at the depth of 11 metres the annual temperature variation disappears or at least is reduced to a small fraction of a degree. As for the propagation of the daily changes in the air temperature, observations made at 0m.10, 0m.25 and 0m.50 show that, at the last depth, the amplitude of diurnal variation is only 0°.07, so that for practical purposes it may be considered that at this depth the temperature difference between night and day disappears.

## ATMOSPHERIC HUMIDITY.

The relative humidity in the Mediterranean zone is, in general, about 10 % less than that of the Littoral; and the absolute humidity, in terms of the pressure of he water vapour, expressed in millimetres of mercury of the barometric column, is on the mean, about 4 mm. less. In the region under consideration, there is a marked difference in the degree of saturation between places only a short distance apart. For example, the observations made in the arid regions of the Salinas Grandes give a mean relative humidity of 58 % and a mean vapour pressure of 10 mm. while at Tucuman, 150 kilometres to the north, the corresponding values are 72 % and 12 mm. being thus as high as in the same latitude in the Littoral. The observations made at Cordoba are typical of the greater part of this zone. The diurnal variation is shown by the values in the following table.

### DIURNAL VARIATION OF THE ATMOSPHERIC HUMIDITY.

| HOUR | RELATIVE HUMIDITY | | | | | PRESSURE OF AQUEOUS VAPOUR | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Summer | Autumn | Winter | Spring | Year | Summer | Autumn | Winter | Spring | Year |
| | % | % | % | % | % | mm. | mm. | mm. | mm. | mm. |
| 1 a. m. | 80 | 83 | 75 | 72 | 78 | 12.7 | 10.2 | 6.0 | 8.4 | 9.3 |
| 2 | 82 | 84 | 76 | 74 | 79 | 12.6 | 10.0 | 5.9 | 8.3 | 9.2 |
| 3 | 83 | 85 | 76 | 75 | 80 | 12.4 | 9.9 | 5.8 | 8.2 | 9.1 |
| 4 | 84 | 86 | 77 | 76 | 81 | 12.2 | 9.7 | 5.8 | 8.2 | 9.0 |
| 5 | 84 | 86 | 78 | 77 | 81 | 12.1 | 9.6 | 5.8 | 8.1 | 8.9 |
| 6 | 83 | 87 | 78 | 77 | 81 | 12.2 | 9.5 | 5.7 | 8.2 | 8.9 |
| 7 | 77 | 86 | 78 | 71 | 78 | 13.1 | 9.7 | 5.7 | 8.8 | 9.3 |
| 8 | 68 | 80 | 74 | 63 | 71 | 13.5 | 10.5 | 5.9 | 9.1 | 9.7 |
| 9 | 62 | 71 | 65 | 56 | 64 | 13.5 | 11.0 | 6.4 | 9.1 | 10.0 |
| 10 | 57 | 64 | 57 | 51 | 57 | 13.4 | 11.1 | 6.6 | 9.2 | 10.1 |
| 11 | 54 | 59 | 52 | 48 | 53 | 13.5 | 11.2 | 6.6 | 9.2 | 10.1 |
| Noon | 52 | 56 | 48 | 45 | 50 | 13.5 | 11.2 | 6.6 | 9.1 | 10.1 |
| 1 p. m. | 50 | 53 | 44 | 43 | 48 | 13.4 | 11.1 | 6.5 | 9.0 | 10.0 |
| 2 | 48 | 52 | 43 | 41 | 46 | 13.3 | 11.1 | 6.4 | 8.9 | 9.9 |
| 3 | 48 | 52 | 43 | 41 | 46 | 13.2 | 11.0 | 6.4 | 8.8 | 9.8 |
| 4 | 48 | 54 | 44 | 41 | 47 | 13.1 | 11.0 | 6.4 | 8.6 | 9.8 |
| 5 | 49 | 58 | 49 | 43 | 50 | 13.0 | 11.0 | 6.4 | 8.5 | 9.7 |
| 6 | 53 | 66 | 57 | 47 | 56 | 13.0 | 11.1 | 6.5 | 8.6 | 9.8 |
| 7 | 60 | 71 | 62 | 54 | 62 | 13.4 | 11.1 | 6.5 | 8.8 | 9.9 |
| 8 | 66 | 76 | 66 | 59 | 67 | 13.5 | 11.0 | 6.4 | 8.9 | 9.9 |
| 9 | 72 | 78 | 68 | 64 | 71 | 13 5 | 10.8 | 6.3 | 8.9 | 9.9 |
| 10 | 76 | 80 | 70 | 67 | 73 | 13.4 | 10.6 | 6.2 | 8.8 | 9.8 |
| 11 | 78 | 81 | 72 | 69 | 75 | 13.1 | 10.4 | 6.1 | 8.7 | 9.6 |
| Midnight | 79 | 82 | 73 | 70 | 76 | 12.9 | 10.2 | 6.0 | 8.6 | 9.4 |
| Average... | 66 | 72 | 64 | 59 | 65 | 13.1 | 10.6 | 6.2 | 8.7 | 9.6 |

From the graphic representation of the hourly values, in Plate XXXI, it is seen that the epoch of the greatest degree of saturation, or highest relative humidity, is not far from sunrise, occurring approximately at the hour of the *minimum* temperature for the day, and the lowest is found between 2 and 3 p. m., thus coinciding with the epoch of the daily *maximum* temperature. For the vapour pressure the principal *minimum* of the day agrees with the *maximum* of the relative humidity, while the secondary falls between 3 and 5 p. m. or shortly after the *minimum* of relative humidity and the *maximum* of temperature.

As for the annual variation of these two factors of the atmospheric humidity, the monthly values for ten well-distributed stations appear in the following table, the means being arranged to show the changes normally experienced during the year. In the heading, the relative humidity is abbreviated to R. H. and the vapour pressure to V. P.

ANNUAL VARIATION OF THE ATMOSPHERIC HUMIDITY IN THE MEDITERRANEAN ZONE

| MONTH | Ing. Esperanza (Jujuy) | | Tucuman | | Santiago del Estero | | Recreo (Catamarca) | | Cordoba | |
|---|---|---|---|---|---|---|---|---|---|---|
| | R. H. | V. P. | R. H. | V. P. | R. H. | V. P. | R. H. | V. P. | R. H. | V. P. |
| | % | | % | | % | | % | | % | |
| January | 72 | 16.3 | 74 | 16.7 | 64 | 17.0 | 56 | 13.6 | 66 | 13.6 |
| February | 72 | 16.3 | 78 | 17.2 | 66 | 17.0 | 59 | 14.0 | 68 | 13.6 |
| March | 82 | 17.0 | 82 | 16.3 | 73 | 17.0 | 66 | 14.7 | 73 | 13.0 |
| April | 81 | 14.5 | 84 | 13.5 | 71 | 13.5 | 68 | 12.5 | 72 | 10.1 |
| May | 80 | 11.2 | 82 | 10.8 | 72 | 10.5 | 67 | 9.6 | 72 | 8.1 |
| June | 72 | 8.8 | 81 | 8.8 | 71 | 8.3 | 64 | 7.4 | 70 | 6.4 |
| July | 69 | 8.8 | 73 | 7.7 | 67 | 8.2 | 61 | 6.8 | 64 | 6.0 |
| August | 60 | 8.4 | 67 | 7.5 | 58 | 7.7 | 53 | 6.4 | 58 | 6.0 |
| September | 56 | 10.7 | 63 | 9.6 | 55 | 9.6 | 46 | 7.8 | 56 | 7.1 |
| October | 63 | 12.8 | 66 | 11.3 | 59 | 11.7 | 51 | 9.7 | 60 | 8.9 |
| November | 66 | 13.9 | 72 | 13.9 | 64 | 14.4 | 51 | 10.9 | 64 | 11.2 |
| December | 71 | 15.7 | 74 | 16.1 | 65 | 16.5 | 57 | 13.4 | 65 | 12.9 |
| Year | 70 | 12.9 | 75 | 12.4 | 66 | 12.6 | 58 | 10.6 | 66 | 9.7 |

| MONTH | Rio Cuarto (Cordoba) | | San Luis | | B. Esperanza (San Luis) | | Victorica (Pampa) | | General Acha (Pampa) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | R. H. | V. P. | R. H. | V. P. | R. H. | V. P. | R. H. | V. P. | R. H. | V. P. |
| | % | | % | | % | | % | | % | |
| January | 60 | 12.4 | 50 | 11.4 | 66 | 13.6 | 48 | 11.7 | 52 | 11.2 |
| February | 64 | 12.9 | 56 | 12.2 | 69 | 13.2 | 58 | 11.1 | 60 | 11.7 |
| March | 72 | 12.8 | 59 | 11.2 | 76 | 13.2 | 63 | 11.6 | 64 | 11.0 |
| April | 72 | 10.1 | 61 | 8.9 | 75 | 10.5 | 73 | 9.3 | 71 | 9.3 |
| May | 73 | 8.2 | 63 | 6.9 | 76 | 7.8 | 75 | 7.8 | 73 | 7.4 |
| June | 74 | 6.8 | 60 | 5.1 | 78 | 6.2 | 73 | 5.1 | 77 | 6.0 |
| July | 68 | 6.0 | 56 | 5.0 | 77 | 6.2 | 69 | 4.9 | 74 | 5.8 |
| August | 62 | 5.6 | 53 | 5.3 | 68 | 5.8 | 64 | 5.2 | 66 | 5.3 |
| September | 63 | 7.4 | 52 | 6.6 | 65 | 7.2 | 64 | 6.4 | 60 | 6.3 |
| October | 62 | 8.5 | 54 | 8.0 | 66 | 8.9 | 66 | 8.1 | 57 | 7.4 |
| November | 65 | 10.7 | 55 | 9.9 | 68 | 11.1 | 60 | 9.5 | 55 | 9.2 |
| December | 64 | 12.0 | 52 | 10.6 | 64 | 11.6 | 51 | 7.8 | 54 | 10.5 |
| Year | 66 | 9.4 | 56 | 8.4 | 71 | 9.6 | 64 | 8.2 | 64 | 8.4 |

From these values it is seen that the saturation is greatest at the end of summer and in the autumn, and is least in the spring. The epochs of the extreme values of the vapour pressure correspond, in general, to those of the temperature.

## STATE OF THE SKY.

A. — *Sunshine.* The duration of sunshine in the Mediterranean zone is indicated from the observations made in Cordoba since 1887, i. e. 21 years of con-

tinuous records, made with the same Campbell sunshine recorder, without change of exposure.

In the following table the first column shows the mean monthly number of hours of sunlight registered, the second, the total number of hours the sun is above the horizon at that latitude, and the third the ratio of the hours observed to the possible hours of sunshine.

SUNSHINE IN CORDOBA.

Latitude 31° 25′

| MONTH | Mean number of hours registered | Hours possible | Relation |
|---|---|---|---|
| | | | % |
| January | 280 | 427 | 66 |
| February | 238 | 369 | 65 |
| March | 235 | 376 | 62 |
| April | 206 | 337 | 61 |
| May | 195 | 322 | 61 |
| June | 157 | 300 | 52 |
| July | 181 | 315 | 57 |
| August | 223 | 337 | 66 |
| September | 232 | 353 | 66 |
| October | 249 | 395 | 63 |
| November | 263 | 407 | 65 |
| December | 269 | 437 | 62 |
| Year | 2,728 | 4,375 | 63 |

To the mean of 63 % recorded by the register we may add 3 % for the early morning and late evening hours when the sun is so low that its rays are not strong enough to make a record on the cardboard strip. Thus we have 66 as the percentage of the time that this region enjoys full sunshine. Grouping the preceding figures to give the relative percentage of clear hours by seasons, we have:—

| | |
|---|---|
| Summer | 64 % |
| Autumn | 51 |
| Winter | 58 |
| Spring | 65 |

The mean diurnal duration of sunshine in each month is as follows:—

| | Hours | | Hours |
|---|---|---|---|
| January | 9.0 | July | 5.8 |
| February | 8.5 | August | 7.2 |
| March | 7.6 | September | 7.7 |
| April | 6.9 | October | 8.0 |
| May | 6.3 | November | 8.8 |
| June | 5.2 | December | 8.7 |

Year ........ 7.5

The following table gives the total number of hours of sunlight registered in each year of this series with the relation to the possible number of hours.

| Year | Total number of hours registered | Proportion % |
|---|---|---|
| 1887 | 2,673 | 61 |
| 1888 | 2,622 | 60 |
| 1889 | 2,437 | 56 |
| 1890 | 2,852 | 65 |
| 1891 | 2,670 | 61 |
| 1892 | 2,874 | 66 |
| 1893 | 2,846 | 65 |
| 1894 | 2,938 | 67 |
| 1895 | 2,856 | 65 |
| 1896 | 2,688 | 62 |
| 1897 | 2,748 | 63 |
| 1898 | 2,795 | 64 |
| 1899 | 2,877 | 66 |
| 1900 | 2,513 | 58 |
| 1901 | 3,137 | 72 |
| 1902 | 2,666 | 61 |
| 1903 | 2,583 | 59 |
| 1904 | 2,621 | 60 |
| 1905 | 2,575 | 59 |
| 1906 | 2,630 | 60 |
| 1907 | 2,525 | 58 |

B.—*Amount of Cloudiness.* The average amount of cloudiness in the Mediterranean zone, deduced from observations made in 25 of the principal stations, is 44,—in the scale of 100. In the north of the zone autumn is the cloudiest season of the year and spring the clearest, while in the southern section winter has the most clouds and spring the least. Long series of observations give a diurnal variation curve showing two *maxima* and two *minima*; the first *maximum* taking place between 8 a. m. and 10 a. m. and the second from 3 to 5 p. m. The principal *minimum* of the day falls about noon and the secondary between 8 and 10 p.m., but, in the daily mean for the whole year, the amplitude of the variation scarcely exceeds one unit of the scale. For more details concerning this element, the reader may refer to the monthly mean values deduced from the tri-daily observations made in ten well-distributed stations in this region.

ANNUAL VARIATION OF THE AMOUNT OF CLOUD.

(IN THE SCALE OF 100.)

| MONTH | Ing. Esperanza | Tucuman | Santiago del Estero | Cordoba | Rio Cuarto |
|---|---|---|---|---|---|
| January | 53 | 64 | 37 | 51 | 39 |
| February | 44 | 67 | 42 | 52 | 42 |
| March | 52 | 66 | 49 | 50 | 41 |
| April | 56 | 65 | 48 | 55 | 42 |
| May | 40 | 55 | 47 | 60 | 52 |
| June | 52 | 57 | 43 | 64 | 52 |
| July | 41 | 43 | 43 | 53 | 49 |
| August | 33 | 46 | 34 | 48 | 41 |
| September | 33 | 47 | 32 | 49 | 43 |
| October | 44 | 59 | 43 | 51 | 43 |
| November | 51 | 64 | 49 | 52 | 42 |
| December | 56 | 62 | 43 | 54 | 41 |
| Year | 46 | 58 | 42 | 53 | 44 |
| MONTH | Arias | San Luis | B. Esperanza | General Acha | Bernasconi |
| January | 40 | 43 | 40 | 36 | 30 |
| February | 39 | 46 | 45 | 40 | 33 |
| March | 39 | 37 | 43 | 44 | 36 |
| April | 62 | 40 | 46 | 46 | 39 |
| May | 51 | 38 | 53 | 47 | 47 |
| June | 57 | 40 | 54 | 46 | 50 |
| July | 46 | 41 | 55 | 50 | 45 |
| August | 35 | 33 | 47 | 43 | 39 |
| September | 48 | 34 | 47 | 46 | 40 |
| October | 42 | 37 | 50 | 46 | 39 |
| November | 31 | 42 | 48 | 43 | 38 |
| December | 35 | 28 | 42 | 41 | 36 |
| Year | 44 | 38 | 47 | 44 | 39 |

*Rain.*—There are marked differences between the different sections of the Mediterranean zone in the mean annual amount of rainfall. The region where it rains most is the eastern slopes of the sierras of Aconquija, where the annual mean is about 1,000 mm.; but the section thus favoured is comparatively small in extent, being limited to a narrow strip in the province of Tucuman. Next we have parts of the eastern section of the province of Cordoba where the normal quantity exceeds 800 mm., as may be seen from the observations from Morteros and Arias. The driest regions are in the west of the province of San Luis and in the southern part of the Pampa Central. Here the annual rainfall scarcely amounts to 500 mm.

As has been previously noted, in almost all the interior of the Republic the greater part of the annual rain falls in the six months from October to March. In

this period the rains are in general short but heavy, while in the autumn the fall is more gentle and prolonged, and in winter there are long rainless periods and then periods of such slight rainfall that the vegetation is but little benefited. The figures in the following tables give the annual variation of the precipitation at 24 points so distributed geographically that they represent the characteristic rainfall of this zone.

ANNUAL VARIATION OF THE RAINFALL IN THE MEDITERRANEAN ZONE.

| MONTH | Ing. Esperanzã (Jujuy) 1895-1907 | R. de la Frontera (Salta) 1902-1907 | Tucuman 1873-1907 | Concepcion (Tucuman) 1892-1907 | La Cocha (Tucuman) 1902-1907 | Santiago del Estero 1873-1907 |
|---|---|---|---|---|---|---|
| | mm. | mm. | mm. | mm. | mm. | mm. |
| January | 115 | 106 | 191 | 154 | 113 | 72 |
| February | 93 | 78 | 172 | 138 | 57 | 81 |
| March | 96 | 194 | 159 | 127 | 160 | 116 |
| April | 54 | 49 | 62 | 81 | 43 | 40 |
| May | 19 | 18 | 23 | 35 | 21 | 15 |
| June | 7 | 5 | 14 | 20 | 8 | 6 |
| July | 5 | 3 | 12 | 13 | 8 | 6 |
| August | 2 | 2 | 11 | 8 | 4 | 2 |
| September | 14 | 16 | 15 | 19 | 7 | 15 |
| October | 20 | 27 | 59 | 33 | 33 | 39 |
| November | 46 | 68 | 103 | 74 | 82 | 54 |
| December | 94 | 163 | 153 | 111 | 105 | 84 |
| Year | 565 | 729 | 974 | 813 | 641 | 530 |

| MONTH | Pinto (Santiago) 1896-1907 | Recreo (Catamarca) 1895-1907 | Quilino (Cordoba) 1902-1907 | Dique S. Roque (Cordoba) 1895-1907 | Cordoba 1873-1907 | Morteros (Cordoba) 1896-1907 |
|---|---|---|---|---|---|---|
| | mm. | mm. | mm. | mm. | mm. | mm. |
| January | 124 | 60 | 60 | 107 | 111 | 110 |
| February | 91 | 95 | 99 | 101 | 108 | 128 |
| March | 62 | 83 | 125 | 97 | 93 | 146 |
| April | 52 | 40 | 31 | 48 | 40 | 65 |
| May | 14 | 82 | 4 | 12 | 20 | 46 |
| June | 2 | 6 | 4 | 5 | 7 | 12 |
| July | 2 | 5 | 7 | 9 | 6 | 22 |
| August | 18 | 6 | 7 | 4 | 10 | 30 |
| September | 8 | 4 | 8 | 20 | 21 | 33 |
| October | 58 | 30 | 20 | 52 | 61 | 83 |
| November | 53 | 44 | 87 | 89 | 108 | 92 |
| December | 74 | 75 | 142 | 113 | 119 | 124 |
| Year | 558 | 530 | 594 | 657 | 704 | 891 |

ANNUAL VARIATION OF THE RAINFALL IN THE MEDITERRANEAN ZONE.

| MONTH | V. Maria (Cordoba) 1886-1907 (with interruptions) | Bell Ville (Cordoba) 1887-1907 | R. Cuarto (Cordoba) 1881-1907 (with interruptions) | Arias (Cordoba) 1899-1907 | La Cautiva (Cordoba) 1902-1907 | San Luis 1900-1907 |
|---|---|---|---|---|---|---|
| | mm. | mm. | mm. | mm. | mm. | mm. |
| January | 96 | 70 | 105 | 88 | 71 | 84 |
| February | 62 | 67 | 89 | 85 | 79 | 75 |
| March | 99 | 79 | 107 | 138 | 122 | 62 |
| April | 63 | 47 | 46 | 53 | 40 | 25 |
| May | 24 | 21 | 25 | 31 | 32 | 16 |
| June | 15 | 16 | 17 | 32 | 8 | 5 |
| July | 14 | 14 | 9 | 17 | 14 | 8 |
| August | 25 | 27 | 21 | 44 | 19 | 9 |
| September | 20 | 27 | 34 | 32 | 22 | 14 |
| October | 60 | 46 | 71 | 84 | 48 | 59 |
| November | 105 | 70 | 111 | 111 | 90 | 88 |
| December | 101 | 102 | 117 | 126 | 82 | 92 |
| Year | 684 | 586 | 752 | 841 | 627 | 537 |

| MONTH | Villa Mercedes (San Luis) 1899-1907 | Buena Esperanza (San Luis) 1903-1907 | General Villegas (Bs. Aires) 1897-1907 | General Uriburu (Pampa) 1897-1907 | General Acha (Pampa) 1897-1907 | Bernasconi (Pampa) 1896-1907 |
|---|---|---|---|---|---|---|
| | mm. | mm. | mm. | mm. | mm. | mm. |
| January | 82 | 64 | 64 | 74 | 66 | 42 |
| February | 70 | 79 | 103 | 84 | 57 | 71 |
| March | 78 | 79 | 122 | 112 | 90 | 74 |
| April | 38 | 32 | 68 | 61 | 48 | 50 |
| May | 20 | 9 | 26 | 31 | 21 | 41 |
| June | 21 | 5 | 23 | 43 | 28 | 37 |
| July | 13 | 11 | 24 | 10 | 22 | 26 |
| August | 20 | 16 | 25 | 18 | 15 | 14 |
| September | 31 | 21 | 40 | 38 | 34 | 31 |
| October | 41 | 51 | 52 | 50 | 33 | 50 |
| November | 66 | 58 | 98 | 80 | 35 | 38 |
| December | 70 | 96 | 88 | 56 | 49 | 55 |
| Year | 550 | 521 | 733 | 657 | 498 | 529 |

In order to show the irregular character of the annual rain distribution the values have been grouped by seasons in the following table.

| | Ing. Esperanza | R. de la Frontera | Tucuman | Concepcion | La Cocha | Santiago del Estero |
|---|---|---|---|---|---|---|
| | mm. | mm. | mm. | mm. | mm. | mm. |
| Summer | 302 | 347 | 516 | 403 | 275 | 237 |
| Autumn | 169 | 261 | 244 | 243 | 224 | 171 |
| Winter | 14 | 10 | 37 | 41 | 20 | 14 |
| Spring | 80 | 111 | 177 | 126 | 122 | 108 |
| | **Pinto** | **Recreo** | **Quilino** | **Dique S. Roque** | **Cordoba** | **Morteros** |
| Summer | 289 | 230 | 301 | 321 | 338 | 362 |
| Autumn | 128 | 205 | 160 | 157 | 153 | 257 |
| Winter | 22 | 17 | 18 | 18 | 23 | 64 |
| Spring | 119 | 78 | 115 | 161 | 190 | 208 |
| | **V. Maria** | **Bell Ville** | **R. Cuarto** | **Arias** | **La Cautiva** | **San Luis** |
| Summer | 259 | 239 | 311 | 299 | 232 | 251 |
| Autumn | 186 | 147 | 178 | 222 | 194 | 103 |
| Winter | 54 | 57 | 47 | 93 | 41 | 22 |
| Spring | 185 | 143 | 216 | 227 | 160 | 161 |
| | **Villa Mercedes** | **B. Esperanza** | **General Villegas** | **General Uriburu** | **General Acha** | **Bernasconi** |
| Summer | 222 | 239 | 255 | 214 | 172 | 168 |
| Autumn | 136 | 120 | 216 | 204 | 159 | 165 |
| Winter | 54 | 32 | 72 | 71 | 65 | 77 |
| Spring | 138 | 130 | 190 | 168 | 102 | 119 |

To illustrate the variations in the annual amount of rainfall we reproduce here the results of the observations made in Cordoba since 1873.

ANNUAL QUANTITY OF RAINFALL IN CORDOBA.

| | mm. | | mm. | | mm. | | mm. |
|---|---|---|---|---|---|---|---|
| 1873 | 891 | 1882 | 484 | 1891 | 800 | 1900 | 712 |
| 1874 | 669 | 1883 | 755 | 1892 | 768 | 1901 | 551 |
| 1875 | 575 | 1884 | 678 | 1893 | 714 | 1902 | 669 |
| 1876 | 947 | 1885 | 692 | 1894 | 767 | 1903 | 988 |
| 1877 | 544 | 1886 | 500 | 1895 | 537 | 1904 | 1,017 |
| 1878 | 989 | 1887 | 529 | 1896 | 616 | 1905 | 586 |
| 1879 | 617 | 1888 | 604 | 1897 | 906 | 1906 | 623 |
| 1880 | 696 | 1889 | 1,006 | 1898 | 672 | 1907 | 654 |
| 1881 | 620 | 1890 | 675 | 1899 | 571 | | |

Mean.........703

The distribution of thunderstorms is very similar to that of rains. They are more frequent in the southern and central portions than in the northern. In the territory of the Pampa the mean annual number of electric storms is 30 to 35 and in the province of Cordoba 40 to 45, while in Tucuman it is reduced to 20 to 25. In Cordoba 85 % of them occur in the rainy season, October to March, which percentage is practically the same in all the interior section of the Republic.

The geographical distribution of hail closely resembles that of electrical storms, since, for this region, it occurs most frequently in Cordoba, least frequently in the north of the region and an average frequency in the Pampa Central. In the observations from Ingenio Esperanza, in the province of Jujuy near the western edge of the great Chaco region, there is but one record of hail in the last five years; in the city of Tucuman the mean annual number is 2, in Cordoba 4 and in General Acha 3. As these storms are oftentimes so destructive to agricultural interests we give here the number of times that hail has been observed during the past ten years at different places in this zone.

| PLACE | Number of hail-storms in ten years |
|---|---|
| Rosario de la Frontera | 9 |
| Tucuman | 19 |
| Santiago (Capital) | 12 |
| San Luis » | 42 |
| Villa Mercedes (San Luis) | 45 |
| Cordoba (Capital) | 44 |
| Rio Cuarto (Cordoba) | 40 |
| Quilino » | 17 |
| Villa Maria » | 26 |
| La Cautiva » | 24 |
| General Alvear (Pampa) | 26 |
| » Villegas » | 22 |
| Victorica » | 32 |
| General Uriburu » | 28 |
| » Acha » | 17 |
| Bernasconi » | 16 |

## EVAPORATION.

The quantity of water evaporated, whether from the surface of the ground or from stationary or moving water surfaces, is a factor so important in the economic life of a region of slight precipitation – like the greater part of the Mediterranean and Andean zones that the results of a long series of observations made in Cordoba with different systems of evaporimeters seem to be of sufficient interest to deserve a limited space in this chapter. In the sections of zones considered arid or semi-arid the annual rainfall is sufficient for agricultural purposes if the precipitation of the rainy season is stored for utilisation in the dry season. The local topography in large sections of these zones lends itself readily to the construction of reservoirs for the water which at present is largely lost by absorption in the sandy soil after having, not unfrequently, caused considerable damage by

flood. The development of agricultural and pastoral industries has been so rapid in later years that already people have begun to feel the necessity of extending the work to sections less favoured by nature. In these the economic occupation of the land depends wholely and directly upon the provision of water both for domestic use and for the irrigation of the soil, whose fertility assures an abundant yield, given the benefit of irrigation.

In technical studies of water storage the amount of evaporation or the intensity of the evaporating elements enters as a fundamental factor into the calculation of the utility of works to be constructed. It is thought that the data here presented may be of use in such studies. The amount of water vapour that enters the air from the surface of the earth represents the evaporative action of temperature, sunshine, atmospheric humidity and wind movements, and the amount of liquid evaporated is an index to the energy expended by these elements; so that, using the same system of determination, the results obtained are directly comparable and give mean values from which the variation in the intensity of the evaporating influences may be judged. Unfortunately, up to the present no uniform method of measuring evaporation has been adopted by the various meteorological services, so that it is difficult to obtain a comparison of results made with various forms of evaporimeters observed under different exposures.

The installation at Cordoba includes most of the systems employed of this class of observations by the various analogous services and consists of:—

1. Two copper dishes, each having a circular superficial area of 314 centimetres and a height of 10 centimetres; one of them placed in the shade of the thermometer shelter and the other exposed to the weather.

2. Two balances of the Wild system with the same exposure as the copper vessels.

3. A glass dish with an area of 380 centimetres and a height of 10 centimetres, having the scale engraved on the glass. This is exposed to the weather at the side of the other two, all of them being at a height of 20 centimetres above the ground.

4. A square tank with an area of one metre and a depth of 80 centimetres, sunk in the ground and exposed to the weather. The height of the water is measured by a continuously recording apparatus.

In addition, observations were made for one year with a Piche evaporimeter, but the results were so much in excess of those given by the other forms that it was evident they could not be relied upon.

This series of observations has been continued without interruption since 1891. The mean monthly evaporation, in millimetres, from each of the evaporimeters exposed to the weather, is as follows:—

| MONTH | Copper Dish | Balance | Glass Dish | Tank |
|---|---|---|---|---|
| | mm. | mm. | mm. | mm. |
| January................ | 215 | 197 | 153 | 144 |
| February.............. | 175 | 165 | 125 | 118 |
| March.................. | 144 | 138 | 103 | 95 |
| April.................... | 97 | 94 | 72 | 69 |
| May...................... | 78 | 73 | 57 | 51 |
| June.................... | 65 | 61 | 47 | 40 |
| July..................... | 89 | 81 | 65 | 50 |
| August........ ...... . | 123 | 116 | 91 | 70 |
| September............ | 156 | 149 | 118 | 93 |
| October................ | 179 | 172 | 136 | 113 |
| November....... ..... | 193 | 183 | 141 | 125 |
| December............. | 209 | 196 | 151 | 136 |
| Year... | 1,723 | 1,625 | 1,259 | 1,104 |

According to these figures the greatest evaporation takes place from the water exposed in the copper dish, the amount diminishing in the other exposures, compared with the copper vessel, by the following amounts — balance 6 %, glass dish 27 %, tank 36 %. As the exposure in the different types of dish is made under similar conditions, the great differences in the observed values are due in large measure to the different temperatures of the water in the various evaporimeters. The water in the tank is somewhat protected from the influence of the wind since its surface is from 12 to 15 cms. below the level of the ground.

The mean diurnal amount of evaporation in each of the exposures is as follows:—

| MONTH | Copper Dish | Balance | Glass Dish | Tank |
|---|---|---|---|---|
| | mm. | mm. | mm. | mm. |
| January................ | 6.9 | 6.4 | 4.9 | 4.6 |
| February............... | 6.2 | 5.8 | 4.5 | 4.2 |
| March.................. | 4.6 | 4.4 | 3.3 | 3.1 |
| April.................... | 3.2 | 3.1 | 2.4 | 2.3 |
| May ...................... | 2.5 | 2.4 | 1.8 | 1.6 |
| June...................... | 2.2 | 2.0 | 1.6 | 1.3 |
| July ...................... | 2.9 | 2.6 | 2.1 | 1.5 |
| August................. | 4.0 | 3.7 | 2.9 | 2.3 |
| September ............ | 5.2 | 5.0 | 3.9 | 3.1 |
| October................ | 5.8 | 5.6 | 4.4 | 3.6 |
| November............. | 6.4 | 6.1 | 4.7 | 4.2 |
| December............ | 6.7 | 6.3 | 4.9 | 4.4 |
| Year... | 4.7 | 4.5 | 3.4 | 3.0 |

The maximum amount of water evaporated in one day, in each month, from the copper dish exposed to the sun, is:—

| | mm. | | mm. |
|---|---|---|---|
| January..... | 20.0 | July.......... | 10.0 |
| February... | 22.4 | August...... | 10.9 |
| March....... | 13.0 | September. | 16.5 |
| April......... | 10.0 | October..... | 19.8 |
| May.......... | 8.5 | November.. | 16.6 |
| June..... .... | 7.4 | December.. | 18.0 |

The diurnal variation of the evaporation shows that about half the daily amount is evaporated between noon and 4 p. m. On the other hand, in the twelve hours between 8 p. m. and 8 a. m., the atmosphere absorbs scarcely 10 % of the total for the 24 hours.

The relation between evaporation and wind direction may be seen from the following table; this shows the normal amount evaporated in a day corresponding to winds from the eight principal directions. The figures are arranged by seasons and are taken from the copper evaporimeter with free exposure.

| SEASON | N. | NE. | E. | SE. | S. | SW. | W. | NW. |
|---|---|---|---|---|---|---|---|---|
| | mm. | mm. | mm. | mm. | mm. | mm. | mm. | mm. |
| Summer....... | 7.2 | 7.0 | 5.9 | 6.2 | 4.4 | 5.4 | 4.8 | 5.1 |
| Autumn....... | 4.3 | 3.7 | 3.5 | 3.8 | 3.8 | 3.7 | 3.4 | 4.0 |
| Winter......... | 3.7 | 3.0 | 2.9 | 3.0 | 3.4 | 2.8 | 2.8 | 3.5 |
| Spring.......... | 7.0 | 6.0 | 5.9 | 5.3 | 4.5 | 4.3 | 5.5 | 5.5 |
| Year...... | 5.6 | 4.9 | 4.5 | 4.6 | 4.0 | 4.0 | 4.1 | 4.5 |

## WIND.

A.—*Frequency.* To illustrate the normal frequency of the winds the results are here given for five stations uniformly distributed over the Mediterranean zone, showing the number of times winds have been observed from each of the eight principal points of the compass. These figures are taken from the 8 a.m., 2 p. m. and 8 p. m. observations of the last five years and are reduced to a scale of 1000 winds per month. The values for the year are the means of the twelve months. The graphic representation of the corresponding annual windroses are seen in Plate XXXII.

RELATIVE MONTHLY FREQUENCY OF THE WIND.

## Tucuman

| MONTH | N. | NE. | NE. | SE. | S. | SW. | W. | NW. | Calm |
|---|---|---|---|---|---|---|---|---|---|
| January | 169 | 119 | 26 | 102 | 95 | 329 | 24 | 89 | 47 |
| February | 147 | 121 | 28 | 139 | 78 | 291 | 21 | 66 | 109 |
| March | 123 | 97 | 30 | 130 | 99 | 298 | 19 | 22 | 182 |
| April | 169 | 120 | 11 | 71 | 87 | 338 | 7 | 33 | 164 |
| May | 172 | 144 | 28 | 75 | 75 | 336 | 2 | 19 | 149 |
| June | 244 | 158 | 16 | 118 | 60 | 242 | 7 | 31 | 124 |
| July | 280 | 107 | 28 | 84 | 75 | 239 | 41 | 73 | 73 |
| August | 265 | 90 | 15 | 134 | 71 | 254 | 47 | 62 | 62 |
| September | 178 | 124 | 31 | 124 | 96 | 349 | 36 | 20 | 42 |
| October | 127 | 131 | 30 | 142 | 112 | 357 | 52 | 21 | 28 |
| November | 137 | 111 | 27 | 71 | 132 | 431 | 18 | 29 | 45 |
| December | 108 | 92 | 43 | 105 | 110 | 413 | 58 | 32 | 39 |
| Year | 176 | 118 | 26 | 108 | 91 | 323 | 28 | 41 | 89 |

## Santiago del Estero

| MONTH | N. | NE. | NE. | SE. | S. | SW. | W. | NW. | Calm |
|---|---|---|---|---|---|---|---|---|---|
| January | 211 | 166 | 204 | 182 | 66 | 5 | 2 | 5 | 159 |
| February | 233 | 148 | 160 | 174 | 100 | 14 | 5 | 2 | 164 |
| March | 224 | 165 | 127 | 136 | 93 | 45 | 2 | 4 | 204 |
| April | 218 | 205 | 105 | 87 | 209 | 2 | 7 | 4 | 163 |
| May | 247 | 176 | 97 | 155 | 80 | 9 | 2 | 6 | 228 |
| June | 229 | 130 | 135 | 151 | 101 | 9 | 11 | 2 | 232 |
| July | 214 | 100 | 110 | 193 | 121 | 13 | 6 | 0 | 243 |
| August | 163 | 122 | 145 | 202 | 130 | 11 | 4 | 2 | 221 |
| September | 240 | 152 | 94 | 154 | 143 | 29 | 9 | 31 | 148 |
| October | 202 | 240 | 147 | 155 | 140 | 11 | 4 | 0 | 101 |
| November | 225 | 160 | 133 | 211 | 111 | 18 | 0 | 4 | 138 |
| December | 257 | 190 | 147 | 170 | 104 | 0 | 11 | 7 | 114 |
| Year | 222 | 163 | 134 | 164 | 117 | 14 | 5 | 5 | 176 |

## Cordoba

| MONTH | N. | NE. | NE. | SE. | S. | SW. | W. | NW. | Calm |
|---|---|---|---|---|---|---|---|---|---|
| January | 173 | 276 | 85 | 139 | 217 | 41 | 27 | 27 | 15 |
| February | 176 | 297 | 103 | 124 | 184 | 50 | 26 | 29 | 11 |
| March | 175 | 294 | 106 | 140 | 177 | 46 | 12 | 25 | 25 |
| April | 191 | 305 | 85 | 117 | 204 | 36 | 16 | 24 | 22 |
| May | 162 | 252 | 93 | 166 | 211 | 53 | 20 | 26 | 17 |
| June | 142 | 238 | 63 | 181 | 246 | 49 | 18 | 32 | 31 |
| July | 183 | 240 | 67 | 153 | 234 | 51 | 18 | 35 | 19 |
| August | 185 | 218 | 72 | 168 | 240 | 40 | 24 | 38 | 15 |
| September | 173 | 255 | 81 | 189 | 225 | 27 | 7 | 18 | 25 |
| October | 144 | 302 | 82 | 161 | 214 | 52 | 16 | 23 | 6 |
| November | 154 | 301 | 87 | 174 | 190 | 42 | 20 | 28 | 4 |
| December | 174 | 278 | 74 | 157 | 194 | 51 | 28 | 32 | 12 |
| Year | 179 | 271 | 83 | 156 | 212 | 45 | 19 | 28 | 17 |

RELATIVE MONTHLY FREQUENCY OF THE WIND.

| MONTH | San Luis | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | N. | NE. | E. | SE. | S. | SW. | W. | NW. | Calm |
| January | 398 | 22 | 468 | 0 | 38 | 21 | 27 | 5 | 21 |
| February | 351 | 18 | 475 | 24 | 24 | 24 | 36 | 12 | 36 |
| March | 408 | 27 | 425 | 70 | 11 | 5 | 32 | 0 | 22 |
| April | 312 | 39 | 454 | 30 | 56 | 9 | 35 | 13 | 52 |
| May | 286 | 100 | 271 | 54 | 43 | 23 | 26 | 20 | 177 |
| June | 309 | 93 | 306 | 53 | 60 | 13 | 13 | 30 | 123 |
| July | 293 | 72 | 307 | 25 | 65 | 14 | 25 | 43 | 156 |
| August | 239 | 35 | 353 | 37 | 25 | 16 | 28 | 42 | 225 |
| September | 294 | 45 | 316 | 45 | 48 | 19 | 38 | 36 | 159 |
| October | 245 | 30 | 420 | 46 | 53 | 9 | 44 | 43 | 110 |
| November | 266 | 47 | 427 | 61 | 35 | 19 | 28 | 19 | 98. |
| December | 310 | 44 | 377 | 88 | 32 | 20 | 7 | 34 | 88 |
| Year | 309 | 48 | 383 | 44 | 41 | 16 | 28 | 25 | 106 |
| | General Acha—(Pampa) | | | | | | | | |
| January | 172 | 170 | 49 | 110 | 114 | 116 | 54 | 73 | 142 |
| February | 140 | 111 | 80 | 104 | 125 | 137 | 83 | 45 | 175 |
| March | 179 | 138 | 22 | 89 | 69 | 156 | 94 | 65 | 188 |
| April | 213 | 129 | 77 | 84 | 96 | 112 | 53 | 57 | 179 |
| May | 163 | 129 | 40 | 62 | 111 | 167 | 69 | 106 | 153 |
| June | 178 | 103 | 40 | 70 | 101 | 205 | 63 | 112 | 128 |
| July | 187 | 84 | 26 | 73 | 153 | 245 | 45 | 88 | 99 |
| August | 144 | 86 | 26 | 99 | 129 | 265 | 64 | 60 | 127 |
| September | 190 | 78 | 72 | 89 | 123 | 203 | 58 | 89 | 98 |
| October | 175 | 142 | 67 | 89 | 116 | 255 | 75 | 46 | 35 |
| November | 181 | 124 | 32 | 121 | 130 | 130 | 76 | 111 | 95 |
| December | 207 | 119 | 45 | 54 | 99 | 180 | 47 | 65 | 184 |
| Year | 177 | 118 | 48 | 87 | 114 | 181 | 65 | 76 | 134 |

B.—*Velocity*. The velocity of the wind in this region, as in the Littoral, increases as we go from north to south, but the wind force in the interior is less than that of the same latitude in the Littoral.

The values given here for the city of Tucuman are characteristic of the greater part of the northen provinces near the Andean region.

Following are the daily velocities and also the maximum 24 hour records. The data are taken from the five-year period since 1902.

VELOCITY OF THE WIND IN TUCUMAN.

| MONTH | Daily Mean | Maximum for the day |
|---|---|---|
| | Kms. | Kms. |
| January | 103 | 268 |
| February | 86 | 250 |
| March | 82 | 197 |
| April | 54 | 172 |
| May | 53 | 125 |
| June | 53 | 154 |
| July | 62 | 293 |
| August | 70 | 162 |
| September | 92 | 235 |
| October | 93 | 185 |
| November | 83 | 198 |
| December | 91 | 244 |
| Year | 77 | 293 |

Thus the mean annual value is 3.2 kilometres per hour; during April, May and June it remains constant with a minimum of 2.2 kilometres.

Passing now to the results obtained from the registers in Cordoba in the period 1895 to 1907, and arranging them in the same form as those for Tucuman, we have the following:—

VELOCITY OF THE WIND IN CORDOBA.

| MONTH | Daily Mean | Maximum for the day |
|---|---|---|
| | Kms. | Kms. |
| January | 222 | 488 |
| February | 212 | 478 |
| March | 198 | 562 |
| April | 192 | 499 |
| May | 182 | 660 |
| June | 186 | 483 |
| July | 211 | 724 |
| August | 245 | 616 |
| September | 278 | 607 |
| October | 286 | 790 |
| November | 261 | 676 |
| December | 232 | 543 |
| Year | 225 | 790 |

Thus we have for Cordoba a mean velocity of 9.4 kms. per hour. April, May and June constitute the period of least wind force, the mean for the three months being 7.8 kms. Farther south, in the territory of the Pampa, the mean velocity reaches 10 to 12 kms., the most windy season being the spring and the least windy the autumn.

For the diurnal variation in the velocity we reproduce the results of the hourly record of the last 12 years in Cordoba, grouped by seasons and the year.

DIURNAL VARIATION IN THE MEAN WIND VELOCITY IN CORDOBA.

| HOUR | Summer | Autumn | Winter | Spring | Year |
|---|---|---|---|---|---|
| | K. | K. | K. | K. | K. |
| 0 to 1 a. m. | 6.0 | 5.5 | 6.4 | 7.4 | 6.3 |
| 1 » 2 | 5.5 | 5.4 | 6.2 | 7.3 | 6.1 |
| 2 » 3 | 5.5 | 5.3 | 6.2 | 7.0 | 6.0 |
| 3 » 4 | 5.6 | 5.3 | 6.2 | 6.9 | 6.0 |
| 4 » 5 | 5.7 | 5.2 | 6.2 | 6.9 | 6.0 |
| 5 » 6 | 5.7 | 5.0 | 5.9 | 6.9 | 5.9 |
| 6 » 7 | 6.6 | 5.1 | 6.3 | 7.8 | 6.4 |
| 7 » 8 | 8.3 | 5.4 | 6.5 | 10.0 | 7.5 |
| 8 » 9 | 10.1 | 6.8 | 7.7 | 12.1 | 9.2 |
| 9 » 10 | 12.0 | 9.3 | 10.3 | 14.5 | 11.5 |
| 10 » 11 | 12.7 | 10.7 | 12.1 | 15.7 | 12.8 |
| 11 » 12 m. | 13.0 | 11.6 | 13.0 | 16.4 | 13.5 |
| 12 » 1 p. m. | 13.6 | 12.4 | 14.1 | 17.2 | 14.3 |
| 1 » 2 | 13.7 | 12.8 | 14.5 | 17.6 | 14.7 |
| 2 » 3 | 13.6 | 13.2 | 14.8 | 17.7 | 14.8 |
| 3 » 4 | 13.7 | 13.2 | 14.6 | 17.8 | 14.8 |
| 4 » 5 | 13.4 | 12.0 | 12.9 | 17.6 | 14.0 |
| 5 » 6 | 12.8 | 9.8 | 9.8 | 15.6 | 12.0 |
| 6 » 7 | 10.9 | 8.0 | 8.2 | 12.6 | 9.9 |
| 7 » 8 | 8.8 | 6.5 | 6.9 | 9.9 | 8.0 |
| 8 » 9 | 7.1 | 5.8 | 6.4 | 7.9 | 6.8 |
| 9 » 10 | 6.1 | 5.6 | 6.3 | 7.3 | 6.4 |
| 10 » 11 | 6.1 | 5.5 | 6.3 | 7.4 | 6.3 |
| 11 » 12 mn. | 5.9 | 5.4 | 6.2 | 7.2 | 6.2 |
| Mean... | 9.2 | 7.9 | 8.9 | 11.5 | 9.4 |

## ANDEAN ZONE.

The north to south extension of this zone is the same as that of the two zones already considered, the Littoral and the Mediterranean; in width it extends from the western limit of the Argentine Pampa to the central range of the Andes. The marked differences in the elevation of the ground give throughout its length an almost purely physical climate, since the hypsometric configuration exercises a far greater influence on the climate than does the direct solar effect. This is shown by the fact that the isotherms run from south to north instead of following parallels of latitude as in regions where the solar climate predominates. Thus elevation is the factor which determines the distinctive climates corresponding to the valleys, table-lands and mountain slopes which compose the greater part of this zone. To the north, in parts of the province of Jujuy and throughout the territory of the Andes are found arid plains with an elevation of more than 4,000 metres above sea level from which rise snow-covered peaks. Farther south, the provinces of Salta, Tucuman, Catamarca, La Rioja, San Juan and Mendoza are

crossed by several ranges of sierras separated by wide or narrow valleys, some of which extend to the pampa region. Ascending from these valleys to the surrounding heights one encounters, within short distances, temperature extremes comparable to those which characterise the equatorial from the polar regions. The rainfall throughout the region is slight. Even in the most favoured sections scarcely enough falls to maintain a scanty vegetation. On the other hand, the valleys supplied with water from the melting snows in the Cordilleras possess great fertility. The numerical values, which show the climatological variations experienced in this zone, are given in the following pages.

## ATMOSPHERIC PRESSURE.

The values relative to the diurnal variation of barometric pressure derived from a long series of observations made in the city of Mendoza, at a height of 800 metres above the sea, are contained in the following table, grouped by seasons.

DIURNAL VARIATION OF THE ATMOSPHERIC PRESSURE IN MENDOZA.

| HOUR | Summer | Autumn | Winter | Spring | Year |
|---|---|---|---|---|---|
| | mm. | mm. | mm. | mm. | mm. |
| 1 a. m. | 692.9 | 694.8 | 696.4 | 694.9 | 694.8 |
| 2 | 92.8 | 94.8 | 96.3 | 94.8 | 94.7 |
| 3 | 92.8 | 94.6 | 96.1 | 94.6 | 94.5 |
| 4 | 92.8 | 94.4 | 96.0 | 94.6 | 94.5 |
| 5 | 93.1 | 94.5 | 95.9 | 94.8 | 94.6 |
| 6 | 93 5 | 94.6 | 96.0 | 95.1 | 94.8 |
| 7 | 93.9 | 95.0 | 96.3 | 95.6 | 95.2 |
| 8 | 94.1 | 95.2 | 96.6 | 95.7 | 95.4 |
| 9 | 94.1 | 95.5 | 96.8 | 95.7 | 95.5 |
| 10 | 93.9 | 95.5 | 96.9 | 95.5 | 95.4 |
| 11 | 93.5 | 95.3 | 96.7 | 95.1 | 95.2 |
| Noon | 93.0 | 94.9 | 96.3 | 94.6 | 94.7 |
| 1 p. m. | 92.3 | 94.3 | 95.6 | 94.0 | 94.0 |
| 2 | 91.7 | 93.7 | 95.0 | 93.3 | 93.4 |
| 3 | 91.1 | 93.3 | 94.8 | 92.9 | 93.0 |
| 4 | 90.7 | 93.1 | 94.8 | 92.7 | 92.8 |
| 5 | 90.4 | 93.2 | 94.9 | 92.7 | 92.8 |
| 6 | 90.5 | 93.4 | 95.3 | 93.0 | 93.0 |
| 7 | 90.9 | 93.8 | 95.7 | 93.5 | 93.5 |
| 8 | 91.5 | 94.2 | 96.1 | 94.0 | 93.9 |
| 9 | 92.2 | 94.6 | 96.3 | 94.6 | 94.4 |
| 10 | 92.6 | 94.9 | 96.5 | 94.8 | 94.7 |
| 11 | 92.8 | 95.0 | 96.6 | 95.0 | 94.8 |
| Midnight | 92.9 | 95.0 | 96.6 | 95.0 | 94.9 |
| Mean........ | 692.5 | 694.5 | 696.0 | 694.4 | 694.4 |

The curves representing the annual variation of pressure show marked differences due, in most cases, to differences in height. The principal *maximum* of the year occurs in August and September, the epoch of greatest pressure showing a retardation as the elevation of the country increases. In the highest regions the secondary *maximum* in April is more pronounced, with a marked depression between it and the principal *maximum.* To better illustrate the different forms of annual variation in the Andean zone, the monthly values for eleven stations, at heights varying from 500 to 3500 metres, are given in the following tables and in graphic form in Plate XXXIII.

ANNUAL VARIATION OF THE ATMOSPHERIC PRESSURE IN THE ANDEAN ZONE.

| MONTH | La Quiaca (Jujuy) | Huma-huaca (Jujuy) | Jujuy | Salta | Andalgala (Catamarca) | Tinogasta (Catamarca) |
|---|---|---|---|---|---|---|
| Latitude. | 22° 10' | 23° 12' | 24° 11' | 24° 46' | 27° 10' | 27° 45' |
| Height.... | 3,492 m. | 3,025 m. | 1,302 m | 1,203 m. | 1,118 m. | 1,261 m. |
| | mm. | mm. | mm. | mm. | mm. | mm. |
| January | 503.4 | 536.0 | 654.2 | 661.2 | 667.6 | 657 9 |
| February | 04.2 | 36.4 | 54.3 | 61.0 | 68.0 | 57.9 |
| March | 04.4 | 37.0 | 54 6 | 61.9 | 68.3 | 58.6 |
| April | 05.1 | 37.2 | 55 4 | 62.9 | 68.8 | 59.7 |
| May | 04.8 | 36.6 | 55.4 | 62.4 | 68.7 | 59.2 |
| June | 04.4 | 36.9 | 55.2 | 62.4 | 68.8 | 59.9 |
| July | 04.4 | 35 8 | 55.1 | 61.9 | 68.8 | 59.0 |
| August | 04.7 | 36.0 | 55.9 | 62.9 | 69.5 | 60.0 |
| September | 06.2 | 37.5 | 55.6 | 62.5 | 68.7 | 59.7 |
| October | 04.0 | 36.5 | 54.7 | 61.9 | 67.8 | 58.7 |
| November | 03.8 | 35.5 | 53.9 | 61.0 | 66.5 | 57.2 |
| December | 03.4 | 35.6 | 53.7 | 60.6 | 66.8 | 56.8 |
| Year... | 504.4 | 536.4 | 654.8 | 661.9 | 668.2 | 658.7 |

| MONTH | Catamarca | La Rioja | Jachal (San Juan) | San Juan | Mendoza |
|---|---|---|---|---|---|
| Latitude.. | 28° 28' | 29° 19' | 30° 13' | 31° 32' | 32° 53' |
| Height.... | 544 m. | 524 m. | 1,204 m. | 652 m. | 800 m. |
| | mm. | mm. | mm. | mm. | mm. |
| January | 714.0 | 716.3 | 662.8 | 702.6 | 692.4 |
| February | 14.2 | 15.9 | 62.1 | 03.0 | 93.0 |
| March | 15.2 | 16 9 | 63.1 | 03.5 | 93.1 |
| April | 17.0 | 17.9 | 63.1 | 05.2 | 94.7 |
| May | 16.9 | 18.5 | 62.8 | 04.8 | 94.2 |
| June | 17.4 | 18.8 | 63.1 | 05.1 | 94.4 |
| July | 17.4 | 18.8 | 64.6 | 04.3 | 94.1 |
| August | 18.3 | 19.6 | 64.7 | 05.9 | 95.5 |
| September | 17.0 | 18.1 | 63.6 | 05.6 | 95.2 |
| October | 16.0 | 17.7 | 63.0 | 04.6 | 94.4 |
| November | 14.4 | 16.2 | 61.8 | 03.0 | 92.7 |
| December | 13.6 | 15.1 | 60.6 | 01.9 | 92.0 |
| Year... | 716.0 | 717.5 | 662.9 | 704.1 | 693.8 |

## TEMPERATURE.

In the Andean zone we find the greatest temperature contrasts, not only in the variation with height but also in the rapid fluctuations which accompany the change of wind from north to south and the large amplitude of the diurnal variation. In the high plateaus it is not rare to observe temperatures below zero in the early morning and above 30° in the afternoon, showing a difference of about 35° between the extremes of the day. From the following mean monthly values, mean *maxima*, mean *minima* and absolute extremes, the general temperature characteristics of the principal centres in the Andean provinces may be seen. The mean monthly temperatures are reduced to the mean of the twenty-four hourly values.

### TEMPERATURE OF THE ANDEAN ZONE.

| MONTH | La Quiaca | | | | | Humahuaca | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | Mean Max. | Mean Min. | Absol. Max. | Absol. Min. | Mean | Mean Max. | Mean Min. | Absol. Max. | Absol. Min. |
| | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° |
| January | 13.1 | 21.6 | 2.9 | 27.0 | — 3.2 | 15.8 | 23.8 | 6.5 | 31.5 | 2.0 |
| February | 13.8 | 23.4 | 4.0 | 30.5 | — 1.0 | 15.3 | 24.4 | 6.3 | 32.0 | 2.0 |
| March | 12.6 | 22.3 | 3.4 | 27.0 | — 2.7 | 14.4 | 24.8 | 6.0 | 31.0 | 1.0 |
| April | 10.2 | 19.9 | —1.6 | 25.2 | — 8.3 | 12.6 | 24.0 | 2.4 | 30.4 | — 6.9 |
| May | 7.8 | 17.8 | —5.3 | 22.6 | —12.0 | 10.1 | 21.2 | —0.6 | 29.0 | — 6.0 |
| June | 4.8 | 17.2 | —9.4 | 24.0 | —16.1 | 8.3 | 19.4 | —3.3 | 26.0 | —11.0 |
| July | 5.1 | 16.3 | —8.0 | 20.0 | —14.2 | 8.0 | 19.6 | —3.5 | 25.5 | —11.2 |
| August | 6.5 | 17.7 | —6.1 | 25.5 | —14.4 | 8.8 | 20.9 | —2.5 | 27.5 | —11.5 |
| September | 9.8 | 20.4 | —2.0 | 27.7 | —13.0 | 11.6 | 24.3 | 0.5 | 31.0 | — 6.0 |
| October | 11.5 | 21.9 | —1.0 | 29.2 | —13.0 | 13.4 | 25.7 | 2.9 | 32.0 | — 5.5 |
| November | 13.8 | 22.4 | 2.4 | 28.3 | — 4.8 | 15.1 | 25.6 | 5.5 | 32.5 | — 1.0 |
| December | 15.3 | 23.7 | 3.3 | 30.0 | — 3.0 | 17.2 | 27.0 | 7.3 | 33.2 | 0.0 |
| Year | 10.4 | 20.4 | —1.4 | 30.5 | —16.1 | 12.3 | 23.4 | 2.3 | 33.2 | —11.5 |
| | Jujuy | | | | | Salta | | | | |
| January | 21.1 | 26.4 | 15.7 | 33.5 | 10.5 | 22.3 | 28.2 | 14.9 | 36.1 | 5.4 |
| February | 21.3 | 26.5 | 17.0 | 34.6 | 10.4 | 22.5 | 27.7 | 15.7 | 36.0 | 6.4 |
| March | 19.9 | 24.7 | 16.2 | 33.5 | 9.0 | 20.1 | 26.1 | 15.0 | 35.5 | 8.4 |
| April | 16.7 | 21.0 | 13.2 | 27.5 | 3.5 | 17.4 | 23.1 | 11.4 | 34.7 | —1.7 |
| May | 14.0 | 18.9 | 10.2 | 28.0 | 0.5 | 15.0 | 21.2 | 7.2 | 37.0 | —3.5 |
| June | 11.8 | 17.1 | 7.3 | 28.5 | —1.5 | 12.5 | 20.4 | 5.2 | 32.7 | —7.5 |
| July | 12.3 | 18.6 | 7.6 | 33.0 | —2.0 | 13.1 | 21.2 | 3.9 | 35.7 | —7.5 |
| August | 12.8 | 19.3 | 7.6 | 32.5 | —2.0 | 13.5 | 21.3 | 5.4 | 36.7 | —4.8 |
| September | 16.7 | 23.2 | 11.4 | 35.0 | 1.0 | 18.1 | 25.3 | 9.4 | 37.7 | —2.4 |
| October | 18.7 | 25.4 | 13.6 | 36.6 | 4.0 | 19.7 | 26.3 | 11.9 | 37.5 | 1.0 |
| November | 20.2 | 26.7 | 15.2 | 38.0 | 6.4 | 21.1 | 26.9 | 14.3 | 37.1 | 3.3 |
| December | 21.3 | 28.0 | 16.2 | 38.0 | 9.0 | 22.3 | 27.2 | 15.3 | 38.2 | 6.5 |
| Year | 17.2 | 23.0 | 12.6 | 38.0 | —2.0 | 18.1 | 24.6 | 10.8 | 38.2 | —7.5 |

TEMPERATURE OF THE ANDEAN ZONE.—*Continued.*

| MONTH | Andalgala | | | | | Tinogasta | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | Mean Max. | Mean Min. | Absol. Max. | Absol. Min. | Mean | Mean Max. | Mean Min. | Absol. Max. | Absol. Min. |
| | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° |
| January | 25.5 | 32.3 | 19.4 | 43.6 | 10.0 | 25.0 | 33.0 | 14.0 | 41.6 | 6.0 |
| February | 24,8 | 31.4 | 19.1 | 40.5 | 10.0 | 24.9 | 33.1 | 14.2 | 39.8 | 6.3 |
| March | 23.1 | 29.4 | 17.4 | 38.4 | 9.0 | 22.7 | 32.1 | 12.7 | 39.3 | 1.6 |
| April | 18.9 | 25.0 | 12.7 | 39.0 | 3.0 | 17.8 | 27.9 | 7.5 | 39.0 | — 1.8 |
| May | 14.6 | 21.4 | 8.2 | 33.0 | —1.0 | 13.7 | 24.7 | 2.4 | 37.0 | — 6.0 |
| June | 10.8 | 17.5 | 4.5 | 35.0 | —2.5 | 10.1 | 21.3 | —1.8 | 36.5 | — 9.3 |
| July | 11.2 | 18.8 | 4.8 | 38.0 | —4.0 | 10.5 | 20.8 | —1.0 | 35.0 | —10.0 |
| August | 12.3 | 20.4 | 6.3 | 37.0 | —1.5 | 11.2 | 22.7 | —0.4 | 35.0 | — 9.0 |
| September | 17.6 | 25.6 | 10.6 | 40.5 | 0.0 | 16.8 | 28.3 | 4.2 | 41.0 | — 6.5 |
| October | 20.5 | 28.5 | 13.7 | 38.0 | 5.0 | 20.1 | 30.8 | 7.4 | 41.1 | 1.0 |
| November | 23.2 | 31.1 | 16.8 | 41.0 | 6.0 | 23.2 | 31.7 | 11.4 | 40.0 | 2.9 |
| December | 25.6 | 33.2 | 19.0 | 42.6 | 9.6 | 26.0 | 33.8 | 13.9 | 43.0 | 7.1 |
| Year | 19.0 | 26.2 | 12.7 | 43.6 | —4.0 | 18.5 | 28.4 | 7.0 | 43.0 | —10.0 |
| | Catamarca | | | | | La Rioja | | | | |
| January | 27.2 | 33.8 | 19.4 | 43.1 | 8.5 | 27.1 | 32.4 | 19.5 | 42.6 | 13.5 |
| February | 26.6 | 32.9 | 20.5 | 40.6 | 14.0 | 26.0 | 32.4 | 19.5 | 41.0 | 12.8 |
| March | 24.1 | 31.4 | 18.3 | 40.2 | 4.9 | 23.8 | 30.4 | 17.4 | 38.5 | 13.2 |
| April | 20.3 | 27.1 | 14.5 | 40.1 | 4.3 | 19.8 | 27.0 | 14.0 | 38.0 | 5.5 |
| May | 16.8 | 23.3 | 10.0 | 35.3 | 0.0 | 16.1 | 21.5 | 9.0 | 34.8 | 0.5 |
| June | 12.6 | 19.6 | 5.0 | 28.0 | —3.5 | 12.8 | 19.4 | 5.4 | 30.0 | —1.7 |
| July | 12.7 | 19.7 | 5.6 | 33.8 | —3.9 | 13.3 | 19.8 | 5.2 | 32.0 | —2.0 |
| August | 15.0 | 22.4 | 6.8 | 35.2 | —2.6 | 14.8 | 22.7 | 7.1 | 34.5 | 0.0 |
| September | 20.0 | 27.4 | 12.6 | 43.4 | —0.5 | 19.6 | 26.3 | 11.4 | 39.0 | 3.5 |
| October | 22.1 | 29.6 | 14.9 | 42.0 | 2.2 | 22.1 | 28.1 | 14.4 | 39.4 | 6.5 |
| November | 24.6 | 31.0 | 17.7 | 40.5 | 7.0 | 24.1 | 30.4 | 17.2 | 40.4 | 9.0 |
| December | 26.8 | 32.2 | 19.3 | 42.2 | 10.8 | 26.2 | 32.2 | 18.5 | 41.0 | 9.9 |
| Year | 20.7 | 27.5 | 13.7 | 43.4 | —3.9 | 20.5 | 26.9 | 13.2 | 42.6 | —2.0 |
| | Jachal | | | | | San Juan | | | | |
| January | 25.4 | 34.0 | 16.1 | 43.5 | 9.0 | 25.8 | 33.9 | 18.1 | 44.0 | 8.0 |
| February | 24.4 | 32.0 | 15.5 | 40.8 | 8.0 | 24.4 | 32.4 | 17.7 | 43.5 | 8.5 |
| March | 22.0 | 30.2 | 13.1 | 38.2 | 2.8 | 21.7 | 29.4 | 14.8 | 42.8 | 5.0 |
| April | 16.4 | 26.3 | 7.7 | 35.6 | 0.0 | 16.6 | 24.6 | 9.9 | 37.0 | 0.2 |
| May | 13.7 | 20.5 | 4.5 | 33.0 | — 2.0 | 12.3 | 19.7 | 5.7 | 34.0 | —2.5 |
| June | 10.3 | 18.7 | 0.7 | 32.0 | —11.0 | 8.4 | 16.3 | 1.8 | 34.0 | —5.0 |
| July | 9.9 | 18.0 | 1.4 | 31.8 | — 7.0 | 9.0 | 17.1 | 1.7 | 33.2 | —5.5 |
| August | 10.5 | 19.9 | 1.7 | 34.0 | — 5.9 | 10.2 | 18.3 | 3.0 | 34.0 | —4.0 |
| September | 15.0 | 24.6 | 5.8 | 38.2 | — 3.0 | 15.0 | 23.2 | 7.4 | 38.0 | —1.0 |
| October | 18.6 | 27.6 | 9.0 | 37.5 | 0.5 | 18.2 | 26.3 | 10.4 | 41.5 | 1.2 |
| November | 22.2 | 30.4 | 12.6 | 43.0 | 5.3 | 21.5 | 29.6 | 12.9 | 41.0 | 5.0 |
| December | 28.0 | 33.4 | 14.6 | 41.1 | 8.5 | 24.6 | 32.4 | 16.8 | 45.5 | 7.5 |
| Year | 17.8 | 26.3 | 8.6 | 43.5 | —11.0 | 17.3 | 25.3 | 10.0 | 45.5 | —5.5 |

TEMPERATURE OF THE ANDEAN ZONE.—*Continued.*

| MONTH | Mendoza | | | | | San Rafael (Mendoza) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | Mean Max. | Mean Min. | Absol. Max. | Absol. Min. | Mean | Mean Max. | Mean Min. | Absol. Max. | Absol. Min. |
| | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° |
| January | 23.4 | 32.7 | 15.4 | 43.0 | 6.8 | 23.5 | 31.5 | 15.5 | 39.0 | 10.1 |
| February | 22.6 | 31.0 | 15.0 | 40.5 | 2.2 | 22.0 | 29.9 | 14.0 | 38.5 | 5.1 |
| March | 20.3 | 27.9 | 12.5 | 36.5 | —1.8 | 20.1 | 28.2 | 12.7 | 36.8 | 5.1 |
| April | 15.6 | 22.7 | 7.9 | 33.0 | —3.0 | 14.8 | 23.7 | 7.5 | 32.2 | —1.2 |
| May | 11.7 | 18.5 | 4.3 | 29.8 | —5.1 | 12.1 | 18.4 | 2.7 | 27.3 | —4.3 |
| June | 7.8 | 14.5 | 1.9 | 30.0 | —9.2 | 8.7 | 14.8 | 0.3 | 27.2 | —6.8 |
| July | 8.5 | 14.7 | 1.5 | 28.0 | —7.8 | 8.1 | 13.9 | 0.1 | 25.3 | —7.3 |
| August | 9.8 | 17.2 | 2.7 | 30.6 | —7.5 | 9.6 | 17.4 | 2.1 | 31.3 | —6.1 |
| September | 13.9 | 21.1 | 6.4 | 36.2 | —4.3 | 12.7 | 18.9 | 4.8 | 31.9 | —1.9 |
| October | 16.6 | 24.7 | 9.4 | 36.7 | —3.6 | 15.4 | 24.2 | 7.7 | 36.2 | 1.6 |
| November | 19.9 | 28.5 | 11.8 | 41.0 | 1.0 | 19.7 | 27.7 | 11.1 | 38.2 | 3.2 |
| December | 22.6 | 31.6 | 13.3 | 42.5 | 4.6 | 21.6 | 29.3 | 12.0 | 35.4 | 2.2 |
| Year | 16.1 | 23.8 | 8.5 | 43.0 | —9.2 | 15.7 | 23.2 | 7.5 | 39.0 | —7.3 |

The mean monthly temperatures for ten of the stations in the preceding tables are graphically expressed in Plate XXXIV.

To show more clearly the character of the different types of temperature variation in this zone, the following table presents the mean diurnal amplitude of the values just given, that is, the difference between the mean *maximum* and the mean *minimum* of each month. These figures may be regarded as the resultant of the combined action of the solar and physical influences experienced in the region of marked surface irregularities under the shelter of the bulwarks of the Cordilleras.

MEAN MONTHLY AMPLITUDE OF TEMPERATURE.

| MONTH | La Quiaca | Humahuaca | Jujuy | Salta | Andalgala | Tinogasta |
|---|---|---|---|---|---|---|
| Height | 3,492 m. | 3,025 m. | 1,302 m. | 1,205 m. | 1,118 m. | 1,261 m. |
| | ° | ° | ° | ° | ° | ° |
| January | 18.7 | 17.3 | 10.7 | 13.3 | 12.9 | 19.0 |
| February | 19.4 | 18.1 | 9.5 | 12.0 | 12.3 | 18.9 |
| March | 18.9 | 18.8 | 8.5 | 11.1 | 12.9 | 19.4 |
| April | 21.5 | 21.6 | 7.8 | 11.7 | 12.3 | 20.4 |
| May | 23.1 | 21.8 | 8.7 | 14.0 | 13.1 | 22.3 |
| June | 26.6 | 22.7 | 9.8 | 15.2 | 13.0 | 23.1 |
| July | 24.3 | 23.1 | 11.0 | 17.3 | 14.0 | 21.8 |
| August | 23.8 | 23.4 | 11.7 | 15.9 | 14.1 | 23.1 |
| September | 22.4 | 23.8 | 11.8 | 15.9 | 15.0 | 24.1 |
| October | 22.9 | 22.8 | 11.8 | 14.4 | 14.8 | 23.4 |
| November | 20.0 | 20.1 | 11.5 | 12.6 | 14.3 | 20.3 |
| December | 20.4 | 19.7 | 11.8 | 11.9 | 14.2 | 19.9 |
| Year | 21.8 | 21.1 | 10.4 | 13.8 | 13.5 | 21.4 |

MEAN MONTHLY AMPLITUDE OF TEMPERATURE.—*Continued.*

| MONTH | Cata-marca | La Rioja | Jachal | San Juan | Mendoza | San Rafael |
|---|---|---|---|---|---|---|
| Height | 544 m. | 524 m. | 1,204 m. | 652 m. | 800 m. | 711 m. |
| | ° | ° | ° | ° | ° | ° |
| January | 14.4 | 12.9 | 17.9 | 15.8 | 17.3 | 16.0 |
| February | 12.4 | 12.9 | 16.5 | 14.7 | 16.0 | 15.9 |
| March | 13.1 | 13.0 | 17.1 | 14.6 | 15.4 | 15.5 |
| April | 12.6 | 13.0 | 18.6 | 14.7 | 14.8 | 16.2 |
| May | 13.3 | 12.5 | 16.0 | 14.0 | 14.2 | 15.7 |
| June | 14.6 | 14.0 | 18.0 | 14.5 | 12.6 | 14.5 |
| July | 14.1 | 14.6 | 16.6 | 15.4 | 13.2 | 13.8 |
| August | 15.6 | 15.6 | 18.2 | 15.3 | 14.5 | 15.3 |
| September | 14.8 | 14.9 | 18.8 | 15.8 | 14.7 | 14.1 |
| October | 14.7 | 13.7 | 18.6 | 15.9 | 15.3 | 16.5 |
| November | 13.3 | 13.2 | 17.8 | 16.7 | 16.7 | 16.6 |
| December | 12.9 | 13.7 | 18.8 | 15.6 | 18.3 | 17.3 |
| Year | 13.8 | 13.7 | 17.7 | 15.3 | 15.3 | 15.7 |

*Solar Temperature.*—From the series of observations made in San Juan during the last five years with a solar maximum black bulb thermometer we extract the following results which give for each month: (1) the mean of the daily observations, (2) the excess of the solar maximum over the air maximum, and, (3) the maximum temperature registered by months of the entire series.

SOLAR THERMOMETER OBSERVATIONS IN SAN JUAN.

| MONTH | Mean Max. Solar Temperature | Excess over Air Temperature | Absol. Max. Solar Temperature |
|---|---|---|---|
| | ° | ° | ° |
| January | 55.1 | 21.2 | 68.0 |
| February | 53.5 | 21.1 | 63.0 |
| March | 49.5 | 20.1 | 61.0 |
| April | 44.0 | 19.4 | 58.0 |
| May | 36.2 | 18.5 | 50.0 |
| June | 30.9 | 14.6 | 50.0 |
| July | 33.0 | 15.9 | 52.0 |
| August | 38.5 | 20.2 | 53.0 |
| September | 44.3 | 21.1 | 66.0 |
| October | 47.8 | 21.5 | 67.0 |
| November | 52.6 | 23.0 | 62.0 |
| December | 54.0 | 21.6 | 64.5 |
| Year | 44.9 | 19.8 | 68.0 |

*Earth Temperature.*—The values here given are taken from five years' observations made in San Juan and Mendoza, with special thermometers which were installed, in the former station, at 0m.10, 0m.20, 0m.30 and 1m.00 below the surface. The latter station had the same equipment and in addition a thermometer at 0m.50 depth. The monthly means of the temperatures observed are as follows:—

EARTH TEMPERATURES.

| MONTH | San Juan | | | | Mendoza | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | DEPTH. | | | | DEPTH. | | | | |
| | 0m.10 | 0m.20 | 0m.30 | 1m.00 | 0m.10 | 0m.20 | 0m.30 | 0m.50 | 1m.00 |
| | ° | ° | ° | ° | ° | ° | ° | ° | ° |
| January | 23.7 | 24.2 | 24.5 | 23.0 | 23.3 | 23.6 | 24.1 | 24.4 | 23.2 |
| February | 22.8 | 23.2 | 23.5 | 22.9 | 22.4 | 22.8 | 23.4 | 23.9 | 23.6 |
| March | 20.8 | 21.1 | 21.5 | 21.7 | 20.6 | 20.9 | 21.5 | 22.1 | 22.3 |
| April | 16.5 | 16.8 | 17.3 | 19.2 | 17.0 | 17.3 | 18.2 | 19.0 | 19.9 |
| May | 12.2 | 12.7 | 13.2 | 15.6 | 12.2 | 12.6 | 13.5 | 14.4 | 16.1 |
| June | 8.0 | 8.6 | 9.2 | 12.0 | 8.2 | 8.5 | 9.4 | 10.2 | 12.3 |
| July | 7.4 | 7.6 | 8.0 | 10.1 | 8.1 | 8.1 | 8.6 | 9.0 | 10.0 |
| August | 9.2 | 9.2 | 9.4 | 10.5 | 9.8 | 9.7 | 10.2 | 10.7 | 11.1 |
| September | 12.7 | 12.5 | 12.5 | 12.1 | 13.6 | 13.5 | 13.6 | 13.7 | 13.1 |
| October | 16.8 | 16.9 | 16.9 | 15.8 | 17.3 | 17.2 | 17.4 | 17.5 | 16.5 |
| November | 19.9 | 20.2 | 20.4 | 18.6 | 19.9 | 19.9 | 20.2 | 20.3 | 19.1 |
| December | 22.3 | 22.8 | 23.1 | 21.4 | 22.0 | 22.2 | 22.6 | 23.0 | 22.0 |
| Year | 16.4 | 16.3 | 16.6 | 16.9 | 16.2 | 16.4 | 16.9 | 17.3 | 17.4 |

HUMIDITY.

The Andean zone is characterised by the remarkable dryness of the air. There are numerous psychrometric observations, carefully made, which give relative humidities of less than 5 °/₀ and a small fraction of a gramme as the actual quantity of water contained in a cubic metre of air.

To show the normal state of this element the monthly values of relative and absolute humidities for 12 places geographically and hypsometrically representative of this zone are given in the following table. The humidity is expressed in percentage of complete saturation and headed R. H. while the vapour pressure is marked V. P.

HUMIDITY IN THE ANDEAN ZONE.

| MONTH | La Quiaca | | Humahuaca | | Jujuy | | Salta | | Andalgala | | Tinogasta | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | R. H. % | V. P. mm. | R. H. % | V. P. mm. | R. H. % | V. P. mm. | R. H. % | V. P. mm. | R. H. % | V. P. mm. | R. H. % | V. P. mm. |
| January | 61 | 6.4 | 67 | 8.8 | 74 | 14.1 | 71 | 13.8 | 50 | 11.3 | 57 | 11.9 |
| February | 64 | 7.1 | 66 | 8.4 | 75 | 14.5 | 74 | 14.2 | 55 | 12.1 | 58 | 12.2 |
| March | 60 | 6.1 | 59 | 7.0 | 80 | 14.3 | 78 | 14.4 | 58 | 11.6 | 61 | 11.9 |
| April | 55 | 4.8 | 49 | 5.1 | 80 | 11.9 | 78 | 11.6 | 60 | 9.4 | 64 | 9.5 |
| May | 53 | 3.8 | 43 | 3.6 | 78 | 9.6 | 75 | 9.4 | 56 | 6.8 | 62 | 6.6 |
| June | 50 | 2.9 | 40 | 2.9 | 74 | 7.7 | 73 | 7.7 | 56 | 5.2 | 57 | 4.6 |
| July | 53 | 3.0 | 45 | 3.2 | 67 | 7.2 | 65 | 6.8 | 48 | 4.5 | 55 | 4.5 |
| August | 51 | 3.5 | 43 | 3.1 | 64 | 7.3 | 60 | 6.6 | 46 | 4.7 | 54 | 4.8 |
| September | 46 | 3.7 | 42 | 4.0 | 66 | 9.6 | 58 | 8.6 | 42 | 6.1 | 48 | 6.4 |
| October | 48 | 4.2 | 49 | 5.1 | 66 | 10.8 | 63 | 10.5 | 43 | 7.2 | 48 | 7.8 |
| November | 47 | 4.9 | 58 | 7.1 | 70 | 12.3 | 66 | 12.2 | 46 | 9.0 | 54 | 10.2 |
| December | 52 | 5.8 | 60 | 8.0 | 74 | 13.9 | 70 | 13.5 | 48 | 10.6 | 52 | 11.1 |
| Year | 53 | 4.7 | 52 | 5.5 | 72 | 11.1 | 69 | 10.8 | 51 | 8.2 | 56 | 8.4 |

| MONTH | Catamarca | | La Rioja | | Jachal | | San Juan | | Mendoza | | San Rafael | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | R. H. % | V. P. mm. | R. H. % | V. P. mm. | R. H. % | V. P. mm. | R. H. % | V. P. mm. | R. H. % | V. P. mm. | R. H. % | V. P. mm. |
| January | 58 | 14.0 | 59 | 14.3 | 57 | 13.5 | 45 | 10.6 | 59 | 13.1 | 52 | 11.2 |
| February | 60 | 14.7 | 63 | 14.9 | 57 | 12.1 | 50 | 10.8 | 64 | 13.6 | 56 | 10.7 |
| March | 67 | 14.5 | 67 | 14.6 | 64 | 11.5 | 53 | 9.9 | 69 | 12.5 | 58 | 10.2 |
| April | 68 | 12.0 | 65 | 11.7 | 61 | 8.2 | 57 | 7.9 | 72 | 9.8 | 58 | 7.2 |
| May | 68 | 9.4 | 67 | 8.6 | 64 | 6.9 | 59 | 6.2 | 75 | 7.8 | 67 | 6.4 |
| June | 66 | 6.9 | 59 | 6.0 | 65 | 5.8 | 60 | 4.8 | 75 | 6.3 | 65 | 5.0 |
| July | 63 | 6.5 | 55 | 5.8 | 62 | 5.3 | 57 | 4.5 | 67 | 5.3 | 65 | 4.8 |
| August | 50 | 6.1 | 50 | 5.9 | 61 | 5.5 | 53 | 4.6 | 66 | 6.0 | 62 | 5.0 |
| September | 47 | 7.9 | 46 | 7.5 | 53 | 6.7 | 46 | 5.6 | 62 | 7.0 | 54 | 5.4 |
| October | 52 | 9.9 | 55 | 9.6 | 55 | 8.8 | 44 | 6.6 | 60 | 8.9 | 53 | 7.8 |
| November | 58 | 12.5 | 54 | 11.2 | 56 | 10.8 | 44 | 8.1 | 58 | 10.6 | 50 | 8.5 |
| December | 58 | 13.6 | 56 | 12.6 | 54 | 12.1 | 44 | 9.6 | 57 | 12.2 | 52 | 10.0 |
| Year | 60 | 10.7 | 58 | 10.2 | 59 | 8.9 | 51 | 7.4 | 65 | 9.4 | 58 | 7.7 |

CLOUDINESS.

The sky is remarkably clear in the north of the Andean zon , as might be expected in so dry a region. It is for this reason that the amplitude of the normal diurnal temperature variation is so large. There are places where frequently the observations indicate a cloudless sky for many successive days. The mean cloudiness of this zone is slightly more than half that of the Littoral region.

To show the normal cloudiness in different localities, the following table gives the monthly means derived from the tri-daily observations made at 8 a.m., 2 p.m. and 8 p.m. The values are expressed in a scale of 100 or ten times greater than that on which they were recorded, a clear sky is indicated by 0 and completely cloudy by 10.

MEAN AMOUNT OF CLOUD IN THE ANDEAN ZONE IN THE SCALE OF 100.

| MONTH | La Quiaca | Humahuaca | Jujuy | Salta | Andalgala |
|---|---|---|---|---|---|
| January | 58 | 61 | 57 | 65 | 40 |
| February | 54 | 59 | 57 | 62 | 42 |
| March | 45 | 51 | 62 | 67 | 38 |
| April | 29 | 31 | 59 | 66 | 33 |
| May | 22 | 20 | 48 | 56 | 31 |
| June | 18 | 18 | 40 | 41 | 31 |
| July | 23 | 28 | 37 | 44 | 26 |
| August | 28 | 26 | 39 | 40 | 28 |
| September | 29 | 28 | 41 | 47 | 24 |
| October | 37 | 37 | 49 | 57 | 31 |
| November | 43 | 44 | 54 | 64 | 38 |
| December | 54 | 53 | 59 | 66 | 37 |
| Mean | 38 | 38 | 50 | 56 | 33 |
| MONTH | Catamarca | La Rioja | San Juan | Mendoza | San Rafael |
| January | 49 | 48 | 27 | 34 | 39 |
| February | 48 | 46 | 30 | 40 | 49 |
| March | 47 | 47 | 23 | 31 | 37 |
| April | 44 | 39 | 26 | 37 | 34 |
| May | 49 | 51 | 31 | 40 | 56 |
| June | 43 | 34 | 32 | 41 | 55 |
| July | 44 | 37 | 26 | 37 | 46 |
| August | 35 | 35 | 28 | 32 | 37 |
| September | 36 | 31 | 24 | 31 | 42 |
| October | 40 | 39 | 25 | 33 | 53 |
| November | 49 | 47 | 24 | 30 | 38 |
| December | 46 | 45 | 23 | 30 | 54 |
| Mean | 44 | 42 | 27 | 35 | 45 |

## RAIN.

The rainfall, although small in all parts of the Andean zone, shows marked differences between adjacent localities, as the result of the differences in the physical surroundings.

The best representation of the mean annual precipitation is found in the following figures which give the mean monthly quantity for 16 stations evenly distributed from north to south.

MEAN MONTHLY RAINFALL IN THE ANDEAN ZONE.

| MONTH | La Quiaca (Jujuy) 1902-1907 | Huma-huaca (Jujuy) 1902-1907 | Tumbaya (Jujuy) 1902-1907 | Jujuy (Capital) 1899-1907 | Salta (Capital) 1873-1907 | Santa Maria (Catamarca) 1897-1907 |
|---|---|---|---|---|---|---|
| | mm. | mm. | mm. | mm. | mm. | mm. |
| January | 117 | 44 | 55 | 168 | 136 | 65 |
| February | 77 | 33 | 38 | 103 | 117 | 37 |
| March | 50 | 31 | 46 | 150 | 100 | 29 |
| April | 22 | 5 | 2 | 38 | 28 | 31 |
| May | 0 | 0 | 0 | 11 | 5 | 0 |
| June | 0 | 0 | 0 | 5 | 1 | 0 |
| July | 0 | 0 | 0 | 5 | 1 | 0 |
| August | 1 | 0 | 0 | 6 | 2 | 0 |
| September | 2 | 0 | 0 | 11 | 7 | 0 |
| October | 11 | 18 | 4 | 48 | 16 | 6 |
| November | 20 | 34 | 14 | 68 | 61 | 12 |
| December | 67 | 37 | 24 | 130 | 97 | 23 |
| Year | 367 | 202 | 183 | 743 | 571 | 203 |

| MONTH | S. Carlos (Salta) 1902-1907 | Andalgala (Catamarca) 1881-1907 | Tinogasta (Catamarca) 1902-1907 | Cata-marca (Capital) 1881-1907 | Chilecito (La Rioja) 1901-1907 | La Rioja (Capital) 1875-1907 with interruptions |
|---|---|---|---|---|---|---|
| | mm. | mm. | mm. | mm. | mm. | mm. |
| January | 36 | 87 | 51 | 72 | 21 | 78 |
| February | 31 | 69 | 19 | 63 | 22 | 49 |
| March | 11 | 56 | 26 | 57 | 20 | 38 |
| April | 2 | 16 | 3 | 19 | 10 | 11 |
| May | 0 | 5 | 0 | 11 | 2 | 2 |
| June | 0 | 2 | 0 | 3 | 1 | 2 |
| July | 0 | 5 | 1 | 4 | 1 | 4 |
| August | 0 | 5 | 0 | 3 | 2 | 2 |
| September | 1 | 3 | 0 | 6 | 0 | 2 |
| October | 1 | 8 | 1 | 22 | 20 | 21 |
| November | 4 | 14 | 1 | 34 | 6 | 32 |
| December | 8 | 20 | 8 | 47 | 20 | 47 |
| Year | 94 | 290 | 110 | 341 | 125 | 288 |

MEAN MONTHLY RAINFALL IN THE ANDEAN ZONE.—*Continued.*

| MONTH | Jachal (San Juan) 1903-1907 | San Juan (Capital) 1875-1907 | Mendoza (Capital) 1885-1907 | S. Rafael (Mendoza) 1903-1907 |
|---|---|---|---|---|
| | mm. | mm. | mm. | mm. |
| January | 62 | 17 | 24 | 34 |
| February | 47 | 8 | 29 | 38 |
| March | 52 | 8 | 25 | 37 |
| April | 3 | 3 | 11 | 8 |
| May | 1 | 3 | 7 | 1 |
| June | 2 | 1 | 6 | 1 |
| July | 7 | 1 | 4 | 0 |
| August | 5 | 1 | 8 | 6 |
| September | 0 | 2 | 11 | 13 |
| October | 51 | 7 | 20 | 13 |
| November | 16 | 5 | 16 | 26 |
| December | 21 | 9 | 22 | 30 |
| Year | 231 | 65 | 183 | 207 |

From these figures it is seen that 90 % of the rain in this zone falls in the rainy season, from October to March, and that from May to September the quantity is so insignificant that it is of no economic benefit. The mean annual number of rainy days in the capitals of the Andean provinces is as follows:—

| | | | |
|---|---|---|---|
| Jujuy | 52 | La Rioja | 38 |
| Salta | 46 | San Juan | 15 |
| Catamarca | 33 | Mendoza | 42 |

Thunderstorms are most frequent in the province of Mendoza, where the annual mean derived from 48 years' records is 28. Their frequency diminishes towards the north and still more so towards the south, since in Chos-Malal, in the northern part of Neuquen, the phenomenon of electrical discharges is rarely observed.

The geographical distribution of hail-storms is similar to that of thunderstorms. The two provinces most subject to this scourge are Jujuy and Mendoza. In the former the total number in the ten-year period is 45 and in the latter 24. In Salta the mean number is 14, in La Rioja 12, in Catamarca 10 and in San Juan only 5, or one in every two years.

## WIND.

A.—*Frequency.* In a region whose surface is as irregular as that of the Andean zone and in which the majority of the observations are made in valleys or near the slopes of the mountains, the wind directions are considerably influenced by the local topography, so that, instead of representing the true direction of the upper currents, they are deviated according to the hypsometric conditions of the place.

All of this region is subject to the *zonda*, a hot, dry, north or northwest wind which burns the vegetation and at times renders breathing difficult. This wind blows most frequently in the spring. In general it lasts only two hours, dying out with the sunset, but at times it continues for days, blowing with a hurricane force. The *zonda* is followed by a cool southerly wind which causes a rapid fall in the temperature, thus re-establishing atmospheric equilibrium. The following tables give, for six stations, the number of winds from each of the eight principal points of the compass, also the number of calms. The values are relative to a 1000 monthly or annual winds deduced from the tri-daily observations of 8 a. m., 2 p. m. and 8 p. m.

RELATIVE MONTHLY FREQUENCY OF WIND IN THE ANDEAN ZONE.

La Quiaca

| MONTH | N. | NE. | E. | SE. | S. | SW. | W. | NW. | Calm |
|---|---|---|---|---|---|---|---|---|---|
| January | 198 | 28 | 157 | 24 | 146 | 28 | 30 | 19 | 370 |
| February | 212 | 33 | 148 | 21 | 207 | 38 | 38 | 26 | 277 |
| March | 177 | 39 | 114 | 45 | 157 | 17 | 47 | 32 | 372 |
| April | 180 | 33 | 105 | 11 | 129 | 20 | 73 | 49 | 400 |
| May | 168 | 22 | 28 | 13 | 159 | 34 | 142 | 62 | 372 |
| June | 161 | 2 | 19 | 5 | 173 | 26 | 149 | 43 | 422 |
| July | 196 | 15 | 28 | 7 | 88 | 19 | 129 | 65 | 453 |
| August | 218 | 31 | 35 | 9 | 88 | 33 | 105 | 66 | 415 |
| September | 247 | 22 | 49 | 13 | 129 | 38 | 84 | 33 | 385 |
| October | 266 | 11 | 84 | 15 | 125 | 26 | 54 | 19 | 400 |
| November | 271 | 27 | 138 | 13 | 131 | 9 | 51 | 24 | 336 |
| December | 228 | 40 | 183 | 27 | 132 | 35 | 46 | 8 | 301 |
| Mean | 210 | 25 | 91 | 17 | 139 | 27 | 79 | 37 | 375 |

Jujuy

| MONTH | N. | NE. | E. | SE. | S. | SW. | W. | NW. | Calm |
|---|---|---|---|---|---|---|---|---|---|
| January | 159 | 124 | 80 | 196 | 63 | 17 | 9 | 230 | 122 |
| February | 204 | 59 | 64 | 209 | 69 | 12 | 28 | 208 | 147 |
| March | 178 | 129 | 149 | 244 | 42 | 7 | 4 | 220 | 27 |
| April | 176 | 140 | 154 | 323 | 55 | 2 | 25 | 123 | 2 |
| May | 144 | 155 | 189 | 261 | 75 | 2 | 13 | 159 | 2 |
| June | 111 | 182 | 173 | 218 | 36 | 2 | 29 | 245 | 4 |
| July | 174 | 142 | 131 | 226 | 71 | 0 | 22 | 234 | 0 |
| August | 138 | 88 | 133 | 282 | 45 | 0 | 47 | 267 | 0 |
| September | 195 | 167 | 147 | 167 | 62 | 0 | 42 | 209 | 11 |
| October | 211 | 163 | 110 | 245 | 52 | 13 | 30 | 170 | 6 |
| November | 216 | 113 | 100 | 214 | 116 | 2 | 20 | 201 | 18 |
| December | 237 | 118 | 103 | 231 | 114 | 7 | 22 | 136 | 32 |
| Mean | 178 | 132 | 128 | 235 | 67 | 5 | 24 | 200 | 31 |

RELATIVE MONTHLY FREQUENCY OF WIND IN THE ANDEAN ZONE.—*Continued.*

### Salta

| MONTH | N. | NE. | E. | SE. | S. | SW. | W. | NW. | Calm |
|---|---|---|---|---|---|---|---|---|---|
| January | 155 | 75 | 30 | 63 | 177 | 22 | 17 | 44 | 417 |
| February | 164 | 245 | 71 | 37 | 87 | 8 | 3 | 26 | 359 |
| March | 122 | 411 | 118 | 25 | 25 | 9 | 9 | 52 | 229 |
| April | 118 | 406 | 144 | 42 | 40 | 7 | 5 | 45 | 193 |
| May | 110 | 442 | 101 | 25 | 34 | 27 | 11 | 36 | 214 |
| June | 108 | 348 | 134 | 61 | 16 | 31 | 12 | 66 | 224 |
| July | 88 | 362 | 146 | 38 | 16 | 29 | 5 | 68 | 248 |
| August | 146 | 387 | 138 | 29 | 7 | 16 | 2 | 52 | 223 |
| September | 92 | 393 | 138 | 67 | 11 | 14 | 2 | 48 | 235 |
| October | 107 | 418 | 143 | 45 | 27 | 11 | 0 | 27 | 222 |
| November | 118 | 393 | 102 | 28 | 19 | 28 | 0 | 33 | 279 |
| December | 87 | 189 | 103 | 131 | 84 | 7 | 2 | 26 | 371 |
| Mean | 118 | 339 | 114 | 49 | 45 | 17 | 6 | 44 | 268 |

### La Rioja

| MONTH | N. | NE. | E. | SE. | S. | SW. | W. | NW. | Calm |
|---|---|---|---|---|---|---|---|---|---|
| January | 116 | 8 | 43 | 119 | 338 | 8 | 35 | 49 | 284 |
| February | 133 | 9 | 27 | 136 | 393 | 3 | 21 | 21 | 257 |
| March | 62 | 14 | 42 | 51 | 444 | 22 | 45 | 14 | 306 |
| April | 45 | 14 | 45 | 36 | 452 | 20 | 59 | 0 | 329 |
| May | 57 | 3 | 14 | 38 | 421 | 22 | 46 | 5 | 394 |
| June | 75 | 0 | 47 | 36 | 364 | 44 | 81 | 0 | 353 |
| July | 46 | 11 | 8 | 75 | 380 | 83 | 96 | 11 | 290 |
| August | 35 | 24 | 54 | 116 | 359 | 97 | 62 | 38 | 215 |
| September | 37 | 32 | 70 | 82 | 479 | 62 | 72 | 17 | 149 |
| October | 67 | 39 | 82 | 69 | 473 | 26 | 32 | 4 | 208 |
| November | 76 | 64 | 78 | 96 | 375 | 33 | 13 | 9 | 256 |
| December | 103 | 59 | 42 | 131 | 409 | 24 | 9 | 13 | 210 |
| Mean | 71 | 23 | 46 | 82 | 407 | 37 | 48 | 15 | 271 |

### San Juan

| MONTH | N. | NE. | E. | SE. | S. | SW. | W. | NW. | Calm |
|---|---|---|---|---|---|---|---|---|---|
| January | 56 | 34 | 73 | 151 | 515 | 116 | 6 | 4 | 45 |
| February | 21 | 17 | 76 | 163 | 489 | 151 | 17 | 5 | 61 |
| March | 39 | 13 | 47 | 151 | 533 | 151 | 6 | 4 | 56 |
| April | 16 | 22 | 49 | 87 | 554 | 158 | 10 | 0 | 104 |
| May | 57 | 29 | 81 | 103 | 395 | 158 | 13 | 11 | 153 |
| June | 44 | 38 | 60 | 51 | 383 | 163 | 29 | 27 | 205 |
| July | 64 | 26 | 80 | 52 | 275 | 215 | 19 | 37 | 232 |
| August | 50 | 26 | 75 | 45 | 312 | 213 | 21 | 21 | 237 |
| September | 40 | 29 | 58 | 81 | 405 | 206 | 22 | 18 | 141 |
| October | 17 | 28 | 56 | 155 | 376 | 206 | 26 | 9 | 127 |
| November | 29 | 18 | 44 | 113 | 389 | 234 | 11 | 9 | 153 |
| December | 19 | 11 | 41 | 148 | 437 | 211 | 9 | 4 | 120 |
| Mean | 38 | 24 | 62 | 108 | 422 | 182 | 16 | 12 | 136 |

RELATIVE MONTHLY FREQUENCY OF WIND IN THE ANDEAN ZONE. *Continued.*

## Mendoza

| MONTH | N. | NE. | E. | SE. | S. | SW. | W. | NW. | Calm |
|---|---|---|---|---|---|---|---|---|---|
| January | 30 | 144 | 209 | 236 | 86 | 150 | 9 | 26 | 110 |
| February | 21 | 151 | 225 | 260 | 83 | 137 | 9 | 24 | 90 |
| March | 26 | 150 | 174 | 252 | 110 | 153 | 11 | 17 | 107 |
| April | 40 | 127 | 180 | 251 | 118 | 100 | 20 | 38 | 126 |
| May | 48 | 137 | 137 | 176 | 238 | 91 | 39 | 28 | 106 |
| June | 58 | 144 | 78 | 151 | 207 | 178 | 69 | 42 | 73 |
| July | 80 | 114 | 123 | 125 | 191 | 178 | 73 | 58 | 58 |
| August | 88 | 112 | 135 | 101 | 209 | 125 | 95 | 60 | 75 |
| September | 47 | 113 | 164 | 193 | 176 | 129 | 53 | 38 | 87 |
| October | 39 | 144 | 168 | 228 | 161 | 86 | 41 | 58 | 75 |
| November | 31 | 132 | 201 | 230 | 157 | 94 | 9 | 36 | 110 |
| December | 22 | 161 | 215 | 295 | 107 | 50 | 15 | 17 | 118 |
| Mean | 44 | 136 | 167 | 208 | 154 | 123 | 37 | 37 | 94 |

The graphic representation of the annual wind frequency for five of these stations is found in Plate XXXV.

B.—*Velocity*. The greater part of the region, being situated in the vicinity of the mountain slopes, is characterised by a low wind velocity. In the provinces of Catamarca, San Juan and La Rioja there are localities where nearly 50 % of the wind observations are noted as calms. On the other hand, in the high plateaus of the territory of the Andes—formerly known as the Puna de Atacama—and in the northern part of Jujuy, the winds are strong, especially during the hotter hours of the day, decreasing in force as the sun sinks, and the clear nights are comparatively calm. The mean diurnal wind movement for each month is given below, derived from anemometric observations made in the city of San Juan since 1903.

| | Kms. | | Kms. |
|---|---|---|---|
| January | 255 | July | 156 |
| February | 218 | August | 182 |
| March | 190 | September | 216 |
| April | 174 | October | 240 |
| May | 160 | November | 255 |
| June | 154 | December | 267 |
| Year: 206, or 8.6 kilometres per hour. | | | |

## PATAGONIAN ZONE.

This climatological zone lies between the 38th and 54th parallels of latitude, its north to south extension being about equal to that of the three northern zones already considered. It includes the territories of Neuquen, Rio Negro, Chubut, Santa Cruz and Tierra del Fuego. The southwest of the territory of Neuquen, called the *Switzerland of America*, is undoubtedly the most picturesque part of the Argentine Republic, possessing a grand system of lakes and streams lying in fertile valleys surrounded by mountains, some of which are snow-covered throughout the year. Lake Nahuel Huapi, the largest lake in the Republic, lies in the southern extremity of this region. It has an area of 540 square kilometres and has a mean discharge of 400 cubic metres per second. In abnormal floods the volume occasionally reaches 1500 cubic metres.

With the exception of the above-mentioned lake district, the surface of the greater part of the region from the Rio Negro to the southern confines of the continental mainland, consists of extensive table-lands which rise in steps from the Atlantic westwards, intercepted at intervals by irregularities or undulations forming depressions of greater or less extent. Low hills border the greater part of the Atlantic coast. In the interior, ranges of hills and peaks rise from the table-lands, those near the western section are, as a rule, foothills or branches of the Cordilleras. As already noted, the climatology of the southern section of the Republic differs essentially from that of the northern section owing to the different system of the atmospheric circulation. To show these differences it will be necessary to refer to the numerical data from stations installed between the coast and the slopes of the Andes.

It is to be noted that for most of the inland stations the series of observations are of relatively short duration, as a few years ago the greater part of these territories, except for a scattered population along the Atlantic coast, were not colonised. Even at present there are extensive tracts which lack systematic meteorological stations. However, the existing data is ample to show with sufficient detail the climatological variations existing in the region except the interior of Tierra del Fuego. In that section no observations have been made except by explorers, and then only during comparatively short periods.

### ATMOSPHERIC PRESSURE.

To illustrate the diurnal pressure variation the hourly values taken from the barograph records of Santa Cruz and Ushuaia, grouped by seasons and for the year in the subjoined table, are graphically represented in Plate XXXVI.

DIURNAL VARIATIO OF ATMOSPHERIC PRESSURE IN THE PATAGONIAN ZONE.

| HOUR | Santa Cruz Height 12 m. | | | | | Ushuaia Height 12 m. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Summer | Autumn | Winter | Spring | Year | Summer | Autumn | Winter | Spring | Year |
| 1 a. m. | 751.4 | 752.4 | 754.6 | 752.5 | 752.7 | 746.4 | 747.3 | 749.8 | 747.0 | 747.6 |
| 2 | 51.3 | 52.4 | 54.5 | 52.4 | 52.7 | 46.3 | 47.3 | 49.8 | 46.9 | 47.6 |
| 3 | 51.3 | 52.3 | 54.5 | 52.3 | 52.6 | 46.3 | 47.2 | 49.8 | 46.8 | 47.5 |
| 4 | 51.4 | 52.2 | 54.4 | 52.3 | 52.6 | 46.3 | 47.1 | 49.7 | 46.7 | 47.5 |
| 5 | 51.5 | 52.2 | 54.5 | 52.4 | 52.7 | 46.4 | 47.1 | 49.7 | 46.8 | 47.5 |
| 6 | 51.6 | 52.3 | 54.5 | 52.5 | 52.8 | 46.5 | 47.1 | 49.8 | 46.9 | 47.6 |
| 7 | 51.8 | 52.4 | 54.6 | 52.6 | 52.9 | 46.5 | 47.1 | 49.8 | 46.9 | 47.6 |
| 8 | 51.7 | 52.5 | 54.8 | 52.7 | 52.9 | 46.5 | 47.1 | 50.0 | 46.9 | 47.6 |
| 9 | 51.6 | 52.5 | 54.8 | 52.5 | 52.8 | 46.3 | 47.0 | 50.0 | 46.9 | 47.5 |
| 10 | 51.4 | 52.5 | 54.8 | 52.3 | 52.8 | 46.2 | 46.9 | 50.0 | 46.9 | 47.5 |
| 11 | 51.2 | 52.4 | 54.8 | 52.1 | 52.6 | 46.1 | 46.7 | 49.9 | 46.8 | 47.4 |
| Noon | 50.9 | 52.2 | 54.7 | 51.9 | 52.4 | 46.0 | 46.5 | 49.7 | 46.7 | 47.2 |
| 1 p. m. | 50.6 | 51.9 | 54.4 | 51.5 | 52.1 | 45.9 | 46.4 | 49.6 | 46.7 | 47.2 |
| 2 | 50.5 | 51.7 | 54.2 | 51.4 | 51.9 | 45.9 | 46.3 | 49.5 | 46.7 | 47.1 |
| 3 | 50.3 | 51.5 | 54.0 | 51.2 | 51.8 | 45.9 | 46.4 | 49.5 | 46.8 | 47.2 |
| 4 | 50.2 | 51.4 | 54.1 | 51.1 | 51.7 | 45.9 | 46.5 | 49.7 | 46.9 | 47.2 |
| 5 | 50.1 | 51.5 | 54.2 | 51.2 | 51.8 | 46.0 | 46.7 | 49.7 | 47.0 | 47.4 |
| 6 | 50.2 | 51.7 | 54.4 | 51.5 | 51.9 | 46.1 | 46.9 | 49.8 | 47.2 | 47.5 |
| 7 | 50.4 | 51.9 | 54.5 | 51.8 | 52.1 | 46.2 | 47.1 | 49.9 | 47.3 | 47.6 |
| 8 | 50.6 | 52.1 | 54.6 | 52.0 | 52.3 | 46.4 | 47.2 | 49.9 | 47.4 | 47.7 |
| 9 | 51.0 | 52.2 | 54.6 | 52.4 | 52.5 | 46.5 | 47.3 | 49.8 | 47.4 | 47.8 |
| 10 | 51.2 | 52.3 | 54.6 | 52.5 | 52.7 | 46.6 | 47.3 | 49.8 | 47.3 | 47.8 |
| 11 | 51.4 | 52.4 | 54.6 | 52.5 | 52.7 | 46.5 | 47.3 | 49.8 | 47.3 | 47.7 |
| Midnight | 51.5 | 52.4 | 54.6 | 52.6 | 52.8 | 46.5 | 47.3 | 49.8 | 47.1 | 47.7 |
| Mean... | 751.0 | 752.1 | 754.5 | 752.1 | 752.4 | 746.2 | 747.0 | 749.8 | 747.0 | 747.5 |

Comparing the curves with those of the diurnal pressure variations in the northern zone, we see in Plate XXXVII a regular decrease in amplitude with increase in latitude.

A difference of 12 millimetres in the normal pressure is found between Rio Negro in the north of this region and Tierra del Fuego in the south. The annual mean decreases from 760 mm. in latitude 39° to 748 mm. in latitude 55°. In order to show the annual pressure variation the monthly means are given for seven stations well-distributed among the southern territories.

ANNUAL VARIATION OF ATMOSPHERIC PRESSURE IN THE PATAGONIAN ZONE.

| | Limay | San Antonio | Trelew | 16 de Octubre | C. Rivadavia | Sta. Cruz | Ushuaia |
|---|---|---|---|---|---|---|---|
| Latitude.... | 39° 0' | 40° 49' | 43° 17' | 43° 5' | 45°53' | 50° 2' | 54° 52' |
| Height...... | 275 m. | 29 m. | 19 m. | 571 m. | 10 m. | 12 m. | 12 m. |
| MONTH | mm. | mm. | mm. | mm. | mm. | mm. | mm. |
| January............ | 735.6 | 755.9 | 755.6 | 711.8 | 753.8 | 752.0 | 746.7 |
| February........... | 36.6 | 56.2 | 55.8 | 11.7 | 54.6 | 52.2 | 47.1 |
| March................ | 36.6 | 57.0 | 56.5 | 11.3 | 53.9 | 50.4 | 45.8 |
| April.................. | 38.6 | 58.7 | 57.7 | 11.2 | 55.6 | 53.9 | 47.6 |
| May.................... | 38.2 | 58.3 | 57.0 | 11.4 | 55.0 | 51.7 | 47.8 |
| June................... | 38.1 | 58.6 | 57.0 | 9.2 | 54.0 | 52.0 | 47.5 |
| July.................... | 39.4 | 59.0 | 58.0 | 9.6 | 55.9 | 54.7 | 49.8 |
| August............... | 40.0 | 60.7 | 59.3 | 10.3 | 56.0 | 54.4 | 49.4 |
| September........... | 38.9 | 59.6 | 58.7 | 10.7 | 55.8 | 54.2 | 47.5 |
| October.............. | 38.4 | 58.4 | 57.8 | 12.0 | 56.0 | 53.7 | 47.6 |
| November........... | 37.6 | 56.7 | 56.1 | 11.4 | 54.2 | 52.1 | 45.3 |
| December........... | 35.6 | 55.3 | 54.9 | 10.3 | 52.2 | 49.9 | 46.6 |
| Year....... | 737.8 | 757.9 | 757.0 | 710.9 | 754.5 | 752.6 | 747.4 |

The monthly means for five of the preceding stations reduced to sea level and to standard gravity at 45° latitude and smoothed by the harmonic formula, are drawn in Plate XXXVIII.

## TEMPERATURE.

From Chart V, which shows the mean annual isotherms, we see that the Patagonian zone lies between the isotherm of 14° in the north and 6° in the south, and that the lines run in a general southeast to northwest direction, thus indicating that the temperature is equally affected by solar and physical influences, the former predominating on the Atlantic coast and the latter in the interior.

The mean annual temperatures in Santa Cruz and Chubut correspond to those in Germany, northern France, Great Britain and the north of the United States.

The diurnal temperature variation is considerably reduced as compared with those in the regions previously considered, as may be seen from the results here given taken from the thermograph records of Santa Cruz and Ushuaia and grouped by seasons. The corresponding curves appear in Plate XXXIX.

DIURNAL VARIATION OF TEMPERATURE IN THE PATAGONIAN ZONE.

| HOUR | Santa Cruz | | | | | Ushuaia | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Summer | Autumn | Winter | Spring | Year | Summer | Autumn | Winter | Spring | Year |
| | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° |
| 1 a. m. | 10.8 | 6.3 | 0.2 | 6.2 | 5.9 | 6.1 | 2.7 | —1.2 | 3.3 | 2.7 |
| 2 | 10.3 | 6.1 | 0.1 | 5.9 | 5.6 | 5.9 | 2.6 | 1.3 | 3.1 | 2.6 |
| 3 | 9.9 | 5.9 | 0.0 | 5.6 | 5.3 | 5.7 | 2.4 | —1.2 | 2.9 | 2.4 |
| 4 | 9.5 | 5.7 | —0.1 | 5.2 | 5.1 | 5.6 | 2.3 | —1.2 | 2.9 | 2.4 |
| 5 | 9.3 | 5.4 | —0.3 | 5.2 | 4.9 | 5.9 | 2.2 | —1.3 | 2.9 | 2.4 |
| 6 | 9.9 | 5.3 | —0.5 | 5.5 | 5.0 | 6.6 | 2.2 | —1.3 | 3.4 | 2.7 |
| 7 | 11.3 | 5.2 | —0.5 | 6.4 | 5.6 | 7.8 | 2.6 | —1.4 | 4.3 | 3.3 |
| 8 | 12.8 | 5.8 | —0.4 | 7.9 | 6.5 | 8.6 | 3.1 | —1.4 | 5.4 | 3.9 |
| 9 | 14.2 | 7.0 | 0.0 | 9.7 | 7.7 | 9.3 | 4.1 | —1.0 | 6.3 | 4.7 |
| 10 | 15.7 | 8.6 | 0.9 | 11.3 | 9.1 | 9.8 | 5.2 | —0.2 | 7.0 | 5.4 |
| 11 | 16.7 | 10.0 | 1.9 | 12.3 | 10.2 | 10.3 | 6.1 | 0.9 | 7.7 | 6.3 |
| Noon | 17.4 | 10.9 | 2.8 | 13.0 | 11.0 | 10.8 | 6.6 | 1.5 | 8.1 | 6.7 |
| 1 p. m. | 17.9 | 11.9 | 3.4 | 13.6 | 11.7 | 11.1 | 6.9 | 1.9 | 8.3 | 7.1 |
| 2 | 18.0 | 12.2 | 3.8 | 13.7 | 11.9 | 11.1 | 7.1 | 1.8 | 8.3 | 7.0 |
| 3 | 18.0 | 12.5 | 3.7 | 13.6 | 12.0 | 11.0 | 6.7 | 1.3 | 8.1 | 6.8 |
| 4 | 17.9 | 12.2 | 3.2 | 13.4 | 11.7 | 10.9 | 6.2 | 0.7 | 7.8 | 6.4 |
| 5 | 17.4 | 11.3 | 2.5 | 12.7 | 11.0 | 10.4 | 5.4 | 0.1 | 7.1 | 5.8 |
| 6 | 16.8 | 10.3 | 1.8 | 11.9 | 10.2 | 9.9 | 4.8 | —0.2 | 6.4 | 5.2 |
| 7 | 15.5 | [illegible].2 | 1.4 | 10.2 | 9.1 | 9.1 | 4.1 | —0.4 | 5.5 | 4.6 |
| 8 | 14.7 | 8.4 | 1.2 | 9.3 | 8.4 | 8.4 | 3.8 | —0.5 | 4.9 | 4.1 |
| 9 | 13.4 | 7.6 | 0.9 | 8.3 | 7.5 | 7.7 | 3.4 | —0.8 | 4.4 | 3.7 |
| 10 | 12.7 | 7.3 | 0.7 | 7.7 | 7.1 | 7.2 | 3.2 | —0.9 | 4.0 | 3.4 |
| 11 | 12.0 | 6.8 | 0.5 | 7.1 | 6.6 | 6.8 | 2.9 | —1.0 | 3.7 | 3.1 |
| Midnight | 11.5 | 6.5 | 0.4 | 6.7 | 6.3 | 6.5 | 2.7 | —1.0 | 3.5 | 2.9 |
| Mean...... | 13.9 | 8.3 | 1.2 | 9.3 | 8.2 | 8.4 | 4.1 | —0.3 | 5.4 | 4.4 |

The annual variation is shown by the monthly mean temperatures, mean *maximum*, mean *minimum*, and absolute extremes for twelve stations.

ANNUAL VARIATION OF TEMPERATURE IN THE PATAGONIAN ZONE.

| MONTH | Limay 1902 to 1907 | | | | | San Antonio 1902 to 1907 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | Mean Max. | Mean Min. | Absol. Max. | Absol. Min. | Mean | Mean Max. | Mean Min. | Absol. Max. | Absol. Min. |
| January | 24.0 | 31.8 | 13.7 | 41.2 | 6.0 | 22.6 | 29.6 | 13.2 | 41.0 | 0.5 |
| February | 22.3 | 29.3 | 11.9 | 41.3 | 1.3 | 21.0 | 27.3 | 10.5 | 41.2 | 0.5 |
| March | 18.9 | 28.2 | 9.0 | 37.1 | 0.1 | 18.6 | 25.6 | 9.9 | 38.0 | 0.5 |
| April | 14.1 | 22.3 | 5.1 | 31.7 | − 4.8 | 14.5 | 20.7 | 6.5 | 31.5 | − 4.4 |
| May | 9.6 | 16.4 | 1.8 | 27.0 | − 6.8 | 10.9 | 15.4 | 5.0 | 25.9 | − 8.0 |
| June | 6.2 | 11.0 | −0.8 | 23.0 | −10.7 | 7.6 | 11.7 | 1.8 | 22.7 | − 7.0 |
| July | 5.4 | 12.0 | −1.7 | 24.5 | −11.8 | 6.4 | 11.6 | 1.5 | 24.0 | −11.0 |
| August | 7.2 | 16.0 | −0.2 | 29.4 | − 9.7 | 8.1 | 15.2 | 1.2 | 30.5 | − 8.1 |
| September | 10.7 | 19.7 | 1.9 | 32.9 | − 7.0 | 11.3 | 18.3 | 3.4 | 32.0 | − 6.0 |
| October | 14.8 | 22.2 | 5.7 | 32.2 | − 2.6 | 14.6 | 21.0 | 5.7 | 34.0 | − 4.3 |
| November | 18.8 | 27.5 | 8.8 | 36.8 | − 0.7 | 18.6 | 26.1 | 9.3 | 38.0 | − 1.3 |
| December | 21.8 | 28.4 | 11.4 | 37.7 | 3.5 | 22.4 | 27.6 | 10.8 | 39.0 | − 2.0 |
| Year | 14.5 | 22.1 | 5.6 | 41.3 | −11.8 | 14.5 | 20.9 | 6.6 | 41.2 | −11.0 |
| | Cholila 1903 to 1907 | | | | | 16 de Octubre 1898 to 1907 | | | | |
| January | 17.5 | 25.7 | 6.0 | 35.0 | − 2.2 | 16.1 | 23.3 | 7.5 | 36.7 | − 1.5 |
| February | 15.2 | 23.0 | 5.2 | 32.6 | − 3.5 | 14.6 | 22.2 | 6.2 | 35.2 | − 2.5 |
| March | 12.4 | 20.1 | 4.8 | 30.0 | − 7.2 | 12.0 | 18.4 | 4.9 | 29.5 | − 7.0 |
| April | 8.5 | 15.5 | 1.9 | 25.5 | − 7.8 | 8.8 | 15.0 | 3.1 | 24.2 | − 5.9 |
| May | 5.4 | 10.6 | −0.4 | 18.5 | −11.2 | 6.1 | 10.7 | 2.0 | 22.0 | − 9.0 |
| June | 2.5 | 6.8 | −1.8 | 15.0 | −12.6 | 2.9 | 6.8 | −0.4 | 18.5 | −20.0 |
| July | 1.5 | 6.1 | −1.7 | 14.2 | −20.2 | 2.1 | 6.2 | −1.2 | 14.5 | −14.0 |
| August | 2.0 | 9.5 | −0.8 | 20.0 | − 9.0 | 3.7 | 9.2 | −0.7 | 18.0 | −12.8 |
| September | 5.6 | 11.2 | 1.3 | 21.5 | − 9.6 | 6.2 | 12.0 | 0.7 | 21.5 | − 7.0 |
| October | 8.5 | 14.9 | 1.3 | 24.7 | − 7.0 | 9.0 | 14.2 | 2.0 | 26.3 | − 6.8 |
| November | 12.5 | 20.0 | 2.6 | 30.8 | − 4.6 | 11.4 | 17.7 | 3.9 | 27.0 | − 4.5 |
| December | 12.7 | 20.2 | 5.3 | 32.0 | − 1.1 | 13.7 | 20.5 | 6.2 | 35.0 | − 3.2 |
| Year | 8.7 | 15.3 | 2.0 | 35.0 | −20.2 | 8.9 | 14.7 | 2.8 | 36.7 | −20.0 |
| | Trelew 1900 to 1907 | | | | | Cabo Raso 1902 to 1907 | | | | |
| January | 21.5 | 30.0 | 11.2 | 41.2 | 3.0 | 17.9 | 25.2 | 12.2 | 38.8 | 5.0 |
| February | 19.8 | 28.2 | 9.9 | 42.2 | − 0.5 | 16.9 | 24.1 | 9.3 | 36.3 | 0.5 |
| March | 17.6 | 25.8 | 6.8 | 38.0 | − 3.5 | 15.7 | 22.5 | 8.4 | 32.0 | 0.2 |
| April | 13.7 | 21.6 | 4.4 | 34.5 | − 7.5 | 12.4 | 18.2 | 6.8 | 29.2 | −1.9 |
| May | 9.6 | 16.1 | 2.6 | 29.0 | −10.0 | 9.4 | 14.1 | 4.6 | 23.6 | −1.8 |
| June | 5.9 | 11.8 | −0.4 | 24.0 | −12.5 | 6.0 | 10.8 | 2.3 | 20.0 | −8.8 |
| July | 5.4 | 11.1 | −1.0 | 20.5 | −12.0 | 5.2 | 10.4 | 1.7 | 20.7 | −7.5 |
| August | 7.7 | 15.0 | 0.0 | 27.8 | −10.0 | 7.0 | 12.5 | 2.8 | 25.4 | −4.0 |
| September | 10.6 | 18.5 | 2.2 | 31.8 | −11.5 | 8.7 | 14.8 | 3.9 | 25.7 | −5.2 |
| October | 13.7 | 22.1 | 4.1 | 40.0 | − 8.0 | 11.2 | 18.1 | 5.3 | 31.4 | −3.0 |
| November | 17.2 | 25.4 | 7.1 | 39.0 | − 1.5 | 14.5 | 21.5 | 7.4 | 34.8 | −0.3 |
| December | 18.7 | 27.1 | 8.6 | 41.0 | − 1.5 | 15.1 | 23.1 | 8.7 | 32.4 | 1.2 |
| Year | 13.4 | 21.1 | 4.6 | 42.2 | 12.5 | 11.7 | 17.9 | 6.1 | 38.8 | −8.8 |

ANNUAL VARIATION OF TEMPERATURE IN THE PATAGONIAN ZONE.—*Continued.*

| MONTH | C. Rivadavia 1903 to 1907 | | | | | Cabo Blanco 1904 to 1907 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | Mean Max. | Mean Min. | Absol. Max. | Absol. Min. | Mean | Mean Max. | Mean Min. | Absol. Max. | Absol. Min |
| January | 19.2 | 26.0 | 12.4 | 39.0 | 2.7 | 15.3 | 20.0 | 9.8 | 32.0 | 4.7 |
| February | 16.8 | 19.8 | 10.4 | 33.0 | 0.7 | 13.9 | 19.7 | 8.5 | 28.5 | 1.3 |
| March | 16.1 | 22.1 | 10.6 | 32.4 | 3.0 | 13.4 | 18.8 | 6.9 | 27.5 | − 2.1 |
| April | 13.0 | 18.1 | 8.7 | 29.5 | 1.0 | 10.7 | 15.6 | 5.3 | 24.0 | − 4.3 |
| May | 9.1 | 14.8 | 4.4 | 24.0 | —5.4 | 6.9 | 12.4 | 2.4 | 18.0 | − 5.0 |
| June | 6.6 | 10.4 | 2.8 | 19.8 | —8.4 | 4.4 | 8.5 | 0.0 | 15.0 | −12.5 |
| July | 5.9 | 10.4 | 2.3 | 21.8 | —6.2 | 3.8 | 8.4 | 0.2 | 14.6 | − 9.0 |
| August | 8.1 | 12.4 | 4.0 | 22.4 | —2.5 | 5.5 | 10.5 | 1.8 | 15.3 | − 3.0 |
| September | 9.9 | 14.6 | 4.3 | 24.6 | —8.0 | 6.6 | 11.4 | 2.4 | 16.4 | − 2.7 |
| October | 12.4 | 18.2 | 6.0 | 30.2 | —5.6 | 9.0 | 13.7 | 4.4 | 23.0 | − 2.0 |
| November | 15.4 | 21.6 | 8.5 | 35.6 | —0.3 | 11.7 | 17.1 | 6.9 | 31.0 | 3.0 |
| December | 15.8 | 21.9 | 8.9 | 34.8 | —2.3 | 12.2 | 17.5 | 7.8 | 26.0 | 1.3 |
| Year | 12.4 | 17.5 | 6.9 | 39.0 | —8.4 | 9.4 | 14.5 | 4.7 | 32.0 | −12.5 |
| | Cañadon 1903 to 1907 | | | | | Santa Cruz 1903 to 1907 | | | | |
| January | 17.3 | 24.2 | 9.5 | 34.9 | 1.0 | 15.9 | 23.8 | 7.9 | 32.6 | 0.0 |
| February | 14.7 | 22.1 | 6.6 | 36.1 | − 3.0 | 14.1 | 21.9 | 7.5 | 31.5 | 0.0 |
| March | 12.8 | 20.5 | 5.8 | 32.0 | − 3.0 | 12.0 | 19.6 | 5.6 | 27.8 | − 1.2 |
| April | 8.8 | 16.2 | 3.4 | 29.0 | 6.0 | 9.0 | 14.4 | 2.6 | 24.8 | 4.3 |
| May | 4.1 | 9.4 | —0.7 | 19.0 | −12.0 | 4.9 | 9.2 | 0.4 | 17.7 | −10.9 |
| June | 1.3 | 5.9 | —2.7 | 15.0 | −13.0 | 1.2 | 5.0 | —2.8 | 13.6 | 17.0 |
| July | 0.0 | 4.8 | —3.8 | 12.9 | −16.0 | 0.6 | 4.5 | —3.6 | 12.5 | −12.9 |
| August | 3.3 | 9.3 | —1.0 | 18.2 | −13.0 | 3.5 | 7.6 | —0.1 | 15.8 | − 6.0 |
| September | 7.0 | 12.9 | 0.3 | 22.0 | − 7.0 | 6.1 | 12.2 | 0.6 | 19.3 | − 6.0 |
| October | 9.9 | 17.4 | 2.3 | 27.0 | − 7.0 | 8.8 | 15.3 | 3.8 | 25.5 | − 6.0 |
| November | 13.6 | 21.6 | 5.2 | 32.0 | − 2.0 | 12.6 | 20.0 | 5.3 | 28.5 | 0.0 |
| December | 13.8 | 20.0 | 6.4 | 34.0 | 0.0 | 12.9 | 19.8 | 7.0 | 33.0 | 1.0 |
| Year | 8.9 | 15.4 | 2.6 | 36.1 | −16.0 | 8.5 | 14.5 | 2.9 | 33.0 | −17.0 |
| | R. Gallegos 1901 to 1907 | | | | | Ushuaia 1904 to 1907 | | | | |
| January | 13.7 | 19.0 | 5.4 | 29.9 | − 3.0 | 10.0 | 14.1 | 5.0 | 27.0 | − 1.0 |
| February | 12.2 | 18.8 | 4.4 | 31.2 | − 2.6 | 9.0 | 13.5 | 4.6 | 26.2 | − 1.2 |
| March | 9.7 | 16.6 | 3.1 | 26.5 | − 6.0 | 7.0 | 11.7 | 2.0 | 22.2 | − 2.6 |
| April | 7.0 | 12.3 | 0.4 | 22.4 | −12.0 | 4.4 | 8.8 | 0.3 | 18.2 | − 6.0 |
| May | 3.3 | 7.5 | —2.8 | 16.5 | −17.6 | 1.0 | 5.0 | —3.2 | 15.0 | −20.2 |
| June | —0.2 | 4.0 | —4.4 | 14.0 | −19.0 | —1.3 | 2.3 | —6.1 | 14.0 | −18.2 |
| July | —0.8 | 2.9 | —5.0 | 12.1 | −17.5 | —1.7 | 2.2 | —6.2 | 12.0 | −19.6 |
| August | 2.0 | 5.7 | —1.8 | 12.3 | −10.5 | 0.8 | 4.9 | —3.8 | 14.8 | −13.0 |
| September | 4.4 | 9.6 | —0.5 | 20.0 | − 7.0 | 3.5 | 7.7 | —1.0 | 16.3 | − 8.0 |
| October | 7.1 | 13.3 | 1.2 | 27.0 | − 8.0 | 5.5 | 10.2 | 0.9 | 21.2 | − 4.2 |
| November | 10.2 | 16.5 | 3.3 | 23.0 | − 8.0 | 7.2 | 12.4 | 2.5 | 23.0 | − 2.8 |
| December | 10.8 | 17.1 | 4.5 | 27.0 | − 3.0 | 7.8 | 12.7 | 3.4 | 26.8 | − 3.0 |
| Year | 6.6 | 11.9 | 0.6 | 31.2 | −19.0 | 4.4 | 8.8 | —0.1 | 27.0 | −20.2 |

To make the data more complete the monthly means and the absolute *maxima* and *minima* for nine other stations are added.

| MONTH | Bariloche 1905 to 1907 | | | Ñorquinco 1903 to 1905 | | | Sierra Grande 1902 to 1907 | | |
|---|---|---|---|---|---|---|---|---|---|
| | Mean | Absol. Max. | Absol. Min. | Mean | Absol. Max. | Absol. Min. | Mean | Absol. Max. | Absol. Min. |
| January | 15.9 | 30.5 | 0.0 | 18.0 | 35.0 | — 5.7 | 21.3 | 39.5 | 6.3 |
| February | 14.8 | 27.5 | 2.0 | 15.8 | 34.2 | — 5.0 | 18.5 | 38.5 | 2.2 |
| March | 12.4 | 29.3 | — 4.0 | 13.5 | 31.5 | — 7.5 | 17.8 | 34.4 | 2.5 |
| April | 8.6 | 22.5 | — 5.0 | 8.6 | 27.1 | — 7.3 | 13.8 | 31.5 | — 2.0 |
| May | 6.0 | 16.0 | — 5.0 | 5.6 | 21.0 | —10.1 | 9.8 | 24.0 | — 4.2 |
| June | 2.6 | 10.5 | — 8.0 | 2.4 | 16.5 | —18.0 | 6.3 | 20.1 | — 5.0 |
| July | 2.3 | 13.0 | — 9.0 | 1.2 | 15.8 | —24.0 | 5.4 | 19.9 | —13.0 |
| August | 3.6 | 17.0 | —12.2 | 3.7 | 21.8 | —16.0 | 8.0 | 27.0 | — 5.0 |
| September | 3.9 | 19.0 | — 6.6 | 5.4 | 24.0 | —10.5 | 10.4 | 29.1 | — 5.0 |
| October | 7.3 | 23.3 | — 4.0 | 8.6 | 24.9 | — 8.5 | 13.3 | 32.0 | — 2.0 |
| November | 11.7 | 31.5 | — 1.0 | 12.9 | 30.5 | — 7.0 | 17.1 | 42.9 | 2.3 |
| December | 10.6 | 30.2 | 0.2 | 13.8 | 30.8 | — 4.0 | 18.9 | 40.5 | 3.1 |
| Year | 8.3 | 31.5 | —12.2 | 9.1 | 35.0 | —24.0 | 13.4 | 42.9 | —13.0 |

| | Tecka 1905 to 1907 | | | Bahia Camarones 1902 to 1907 | | | Colonia Sarmiento 1903 to 1907 | | |
|---|---|---|---|---|---|---|---|---|---|
| | Mean | Absol. Max. | Absol. Min. | Mean | Absol. Max. | Absol. Min. | Mean | Absol. Max. | Absol. Min. |
| January | 16.9 | 36.0 | 2.2 | 18.1 | 38.0 | 5.3 | 19.4 | 37.0 | 1.5 |
| February | 15.0 | 30.4 | — 3.0 | 18.1 | 37.5 | 5.1 | 16.3 | 35.5 | 1.2 |
| March | 11.7 | 29.2 | —10.2 | 16.3 | 33.0 | 3.0 | 14.3 | 32.8 | — 3.0 |
| April | 7.8 | 27.0 | —13.2 | 13.0 | 32.4 | 1.0 | 10.9 | 27.4 | — 3.0 |
| May | 4.8 | 18.4 | —14.0 | 9.9 | 23.5 | — 2.8 | 6.0 | 21.5 | —11.0 |
| June | — 2.0 | 10.0 | —29.0 | 6.2 | 17.6 | — 6.0 | 2.4 | 18.0 | —11.6 |
| July | 1.5 | 13.6 | —17.0 | 5.6 | 18.9 | — 9.5 | 2.4 | 20.0 | —33.0 |
| August | 4.3 | 16.2 | —10.8 | 7.2 | 20.5 | — 3.6 | 5.3 | 18.0 | —16.0 |
| September | 4.1 | 14.8 | —12.5 | 9.2 | 20.9 | — 6.4 | 7.5 | 24.5 | —10.0 |
| October | 7.7 | 25.8 | —16.0 | 11.5 | 29.0 | — 2.3 | 10.8 | 29.8 | — 7.2 |
| November | 11.9 | 31.8 | — 3.4 | 14.9 | 30.0 | 0.4 | 14.2 | 33.0 | — 1.2 |
| December | 12.3 | 31.9 | 0.0 | 16.2 | 32.8 | 4.5 | 15.2 | 37.0 | 0.0 |
| Year | 8.0 | 36.0 | —29.0 | 12.2 | 38.0 | — 9.5 | 10.4 | 37.0 | —33.0 |

| MONTH | San Julian 1903 to 1907 | | | Puerto Coyle 1905 to 1907 | | | Puerto Harberton 1903 to 1907 | | |
|---|---|---|---|---|---|---|---|---|---|
| | Mean | Absol. Max. | Absol. Min. | Mean | Absol. Max. | Absol. Min. | Mean | Absol. Max. | Absol. Min. |
| January............ | 16.3 | 34.0 | 4.5 | 14.7 | 32.0 | 1.0 | 10.3 | 27.2 | — 0.5 |
| February.......... | 14.5 | 32.0 | 1.0 | 13.1 | 30.2 | — 0.6 | 9.2 | 29.4 | — 1.5 |
| March.............. | 13.0 | 30.0 | — 3.0 | 10.9 | 27.4 | — 3.2 | 7 3 | 24.0 | — 3.0 |
| April ....... ...... | 10.0 | 28.5 | — 4.0 | 8.2 | 27.3 | — 7.0 | 5.7 | 19.2 | — 5.8 |
| May................. | 5.0 | 22.0 | —10.5 | 4.0 | 19.1 | —16.5 | 2.5 | 17.5 | —12.0 |
| June ............... | 2.5 | 15.0 | —13.0 | 0.8 | 12.2 | —20.5 | 0.8 | 13.0 | —10.5 |
| July................. | 1.8 | 13.6 | —12.4 | 1.5 | 10.7 | —19.2 | 0.6 | 12.2 | —13.0 |
| August............ | 4.4 | 19.0 | — 5.0 | 3.6 | 15.4 | — 8.0 | 2.1 | 14.2 | — 7.5 |
| September......... | 6.8 | 22.2 | — 6.0 | 5.4 | 19.1 | — 6.5 | 4.2 | 15.5 | — 6.0 |
| October............ | 9.6 | 27.0 | — 3.5 | 8.0 | 23.5 | — 3.5 | 6.2 | 20.6 | — 4.5 |
| November......... | 13.0 | 29.0 | 1.0 | 11.3 | 23.0 | — 1.0 | 8.1 | 23.5 | — 3.0 |
| December.. ....... | 12.9 | 32.5 | 0.5 | 11.7 | 29.9 | — 1.5 | 8.7 | 25.0 | — 1.5 |
| Year... | 9.2 | 34.0 | —13.0 | 7.8 | 32.0 | —20.5 | 5.5 | 29.4 | —13.0 |

The curve of the annual variation of the temperature for eight of the foregoing stations is found in Plate XL.

### HUMIDITY.

In the geographical distribution of the humidity of the air, well pronounced differences are found between the distinct sections of this zone. The greatest degree of saturation corresponds to Staten Island and the south coast of Tierra del Fuego; after that comes the lake region of Neuquen. On the Atlantic coast the sea winds are the most humid, but with the prevailing west winds the humidity is much reduced. On the table-lands of the interior the dryness is similar to that of the eastern portion of the Andean region. For further details regarding this element the reader is referred to the monthly values of the relative and absolute humidity contained in the tables that follow. These values are derived from the mean of the tri-daily observations taken at 8 a. m., 2 p. m. and 8 p. m. The relative humidity is expressed in percentages of complete saturation of the air, and the absolute in terms of the pressure of water vapour.

ANNUAL VARIATION OF HUMIDITY IN THE PATAGONIAN ZONE.

| MONTH | LIMAY | | SAN ANTONIO | | BARILOCHE | | TRELEW | | 16 DE OCTUBRE | | C. S. MARTIN | | C. SARMIENTO | | COMODORO RIVADAVIA | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | R. H. | V. P. | R. H. | V. P. | R. H. | V. P. | R. H. | V. P. | R. H. | V. P. | R. H. | V. P. | R. H. | V. P. | R. H. | V. P. |
| January.. | 43 | 8.6 | 66 | 12.9 | 71 | 9.4 | 45 | 7.7 | 65 | 8.6 | 53 | 6.6 | 46 | 7.0 | 55 | 8.6 |
| February | 48 | 8.9 | 66 | 12.0 | 72 | 8.8 | 46 | 7.1 | 66 | 8.0 | 52 | 5.6 | 51 | 6.5 | 62 | 8.6 |
| March.... | 51 | 8.2 | 70 | 10.9 | 75 | 8.1 | 49 | 6.8 | 72 | 7.5 | 69 | 7.3 | 53 | 6.2 | 59 | 7.8 |
| April...... | 53 | 6.3 | 73 | 9.0 | 78 | 6.7 | 56 | 6.3 | 76 | 6.5 | 69 | 5.4 | 59 | 5.7 | 64 | 7.1 |
| May....... | 67 | 5.9 | 76 | 7.5 | 79 | 5.7 | 64 | 5.8 | 83 | 6.0 | 77 | 4.7 | 69 | 4.8 | 67 | 5.8 |
| June...... | 74 | 5.0 | 81 | 6.5 | 82 | 4.6 | 72 | 5.2 | 86 | 5.0 | 79 | 3.9 | 72 | 4.2 | 65 | 4.8 |
| July....... | 72 | 4.8 | 78 | 6.7 | 85 | 4.7 | 70 | 4.7 | 87 | 4.8 | 80 | 4.1 | 77 | 4.4 | 68 | 4.7 |
| August... | 59 | 4.4 | 72 | 5.8 | 83 | 5.1 | 62 | 4.8 | 81 | 5.0 | 73 | 4.5 | 70 | 4.7 | 63 | 5.1 |
| Sept. ... | 50 | 4.8 | 70 | 6.9 | 77 | 4.8 | 53 | 4.8 | 77 | 5.6 | 71 | 4.4 | 61 | 4.7 | 64 | 5.9 |
| Oct........ | 50 | 5.7 | 67 | 8.0 | 74 | 5.7 | 49 | 5.3 | 74 | 6.4 | 68 | 5.3 | 54 | 5.1 | 65 | 6.8 |
| Nov....... | 43 | 6.4 | 61 | 9.3 | 68 | 6.9 | 44 | 5.8 | 71 | 7.2 | 66 | 6.5 | 50 | 5.7 | 54 | 6.7 |
| Dec. ....... | 42 | 7.1 | 62 | 10.8 | 78 | 7.5 | 43 | 6.4 | 68 | 8.0 | 64 | 6.1 | 51 | 6.2 | 53 | 6.7 |
| Year.... | 54 | 6.3 | 70 | 8.8 | 77 | 6.5 | 54 | 5.9 | 75 | 6.6 | 69 | 5.4 | 60 | 5.4 | 62 | 6.6 |

| MONTH | CABO BLANCO | | CAÑADON | | SAN JULIAN | | SANTA CRUZ | | R. GALLEGOS | | USHUAIA | | STATEN ISLAND | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | R. H. | V. P. | R. H. | V. P. | R. H. | V. P. | R. H. | V. P. | R. H. | V. P. | R. H. | V. P. | R. H. | V. P. |
| January.. | 60 | 8.0 | 74 | 11.7 | 71 | 9.8 | 61 | 8.3 | 67 | 7.7 | 71 | 6.5 | 77 | 6.7 |
| February | 64 | 7.7 | 71 | 9.8 | 68 | 8.3 | 64 | 7.9 | 69 | 7.3 | 73 | 6.2 | 78 | 6.7 |
| March.... | 66 | 7.7 | 68 | 8.1 | 67 | 7.5 | 62 | 6.7 | 62 | 5.4 | 78 | 6.0 | 79 | 6.4 |
| April ..... | 76 | 7.5 | 82 | 7.0 | 76 | 7.2 | 67 | 5.8 | 77 | 5.8 | 83 | 5.3 | 82 | 5.9 |
| May....... | 81 | 6.1 | 85 | 5.8 | 82 | 5.5 | 77 | 5.1 | 85 | 5.1 | 84 | 4.2 | 84 | 5.4 |
| June...... | 84 | 5.9 | 92 | 5.1 | 84 | 4.6 | 80 | 4.0 | 89 | 4.1 | 89 | 3.9 | 87 | 4.9 |
| July....... | 84 | 5.0 | 92 | 4.5 | 84 | 4.4 | 84 | 4.1 | 90 | 4.0 | 89 | 4.0 | 86 | 4.8 |
| August... | 83 | 5.7 | 89 | 5.5 | 76 | 4.7 | 85 | 5.0 | 87 | 4.7 | 82 | 3.9 | 84 | 4.7 |
| Sept....... | 71 | 5.2 | 78 | 6.3 | 70 | 5.0 | 68 | 4.7 | 76 | 4.8 | 73 | 4.3 | 81 | 5.0 |
| Oct........ | 69 | 6.0 | 64 | 5.8 | 69 | 6.1 | 60 | 5.1 | 73 | 5.5 | 73 | 5.0 | 79 | 5.4 |
| Nov.... | 64 | 6.6 | 64 | 7.8 | 70 | 7.7 | 56 | 6.0 | 59 | 5.4 | 70 | 5.2 | 76 | 5.6 |
| Dec......... | 69 | 7.4 | 77 | 10.0 | 70 | 7.8 | 57 | 6.4 | 66 | 6.5 | 74 | 5.7 | 76 | 6.2 |
| Year .... | 73 | 6.6 | 78 | 7.3 | 74 | 6.6 | 68 | 5.8 | 75 | 5.5 | 78 | 5.0 | 81 | 5.6 |

## CLOUDINESS.

The distribution of the mean cloud amount is practically the same as that of the relative humidity, the greatest degree of cloudiness being found in Staten Island and in the region of Tierra del Fuego, and the clearest skies in the territory of Rio Negro. The monthly values deduced from estimation of the amount of cloud, made at 14 stations of this zone, are shown in the following table, expressed in the scale of 100.

ANNUAL VARIATION OF CLOUDINESS IN THE PATAGONIAN ZONE.

| MONTH | Limay | San Antonio | Sierra Grande | Ñorquinco | 16 de Octubre | Trelew | Camarones | Colonia Sarmiento | Comodoro Rivadavia | Cabo Blanco |
|---|---|---|---|---|---|---|---|---|---|---|
| January | 34 | 25 | 31 | 42 | 46 | 40 | 37 | 44 | 53 | 40 |
| February | 32 | 26 | 34 | 44 | 44 | 41 | 44 | 42 | 47 | 44 |
| March | 33 | 22 | 34 | 52 | 50 | 41 | 39 | 44 | 48 | 44 |
| April | 48 | 33 | 41 | 58 | 57 | 45 | 44 | 45 | 44 | 48 |
| May | 60 | 42 | 52 | 60 | 68 | 58 | 57 | 59 | 49 | 58 |
| June | 60 | 43 | 47 | 61 | 63 | 51 | 54 | 49 | 47 | 54 |
| July | 55 | 39 | 41 | 53 | 66 | 50 | 49 | 53 | 52 | 54 |
| August | 50 | 33 | 38 | 52 | 58 | 46 | 42 | 51 | 52 | 47 |
| September | 38 | 35 | 43 | 52 | 56 | 47 | 44 | 48 | 47 | 45 |
| October | 52 | 31 | 37 | 49 | 50 | 43 | 40 | 43 | 51 | 42 |
| November | 39 | 29 | 38 | 44 | 54 | 44 | 37 | 45 | 53 | 39 |
| December | 41 | 28 | 31 | 53 | 51 | 46 | 44 | 50 | 60 | 46 |
| Year | 45 | 35 | 39 | 52 | 55 | 46 | 44 | 48 | 50 | 47 |

| MONTH | Santa Cruz | R. Gallegos | Ushuaia | Staten Island |
|---|---|---|---|---|
| January | 55 | 76 | 73 | 72 |
| February | 53 | 73 | 68 | 72 |
| March | 49 | 66 | 64 | 75 |
| April | 52 | 64 | 53 | 79 |
| May | 52 | 62 | 64 | 79 |
| June | 50 | 64 | 55 | 81 |
| July | 51 | 64 | 57 | 75 |
| August | 49 | 68 | 57 | 75 |
| September | 40 | 61 | 59 | 73 |
| October | 47 | 66 | 66 | 70 |
| November | 47 | 71 | 65 | 70 |
| December | 58 | 79 | 71 | 74 |
| Year | 50 | 68 | 63 | 75 |

## RAIN.

Charts XV, XVI and XVII show the general distribution of the rainfall, by seasons and for the year. But in view of the increasing interest in the pastoral and agricultural conditions of the southern territories and the rapid increase of population, it seems advisable to illustrate in greater detail the general character of the precipitation by means of numerical data from a considerable number of stations, since, in this zone, the normal quantity varies essentially between places separated by short distances. In this respect the greatest difference is found in the southeast part of the territory of Neuquen; the western section has an annual fall of 1500 mm., while 200 kilometres to the east, it barely reaches 200 millimetres.

Over extensive regions in the south central part of the territory of Rio Negro and in the central north of Chubut, also in the interior of Santa Cruz, it has not been possible to obtain systematic observations for a complete period of one year, but it is most probable that the same scarcity of rain exists in the interior of the Rio Negro and Chubut as on the Atlantic coast and the western limit of these territories. On the other hand, in the western part of Santa Cruz it is probable that the rainfall is greater than that near the coast, the quantity increasing on approaching the Cordilleras.

In the territory of Rio Negro, slight snowstorms are occasionally observed, but usually the snow melts soon after it reaches the ground; the same occurs on the Atlantic coast of the territories of Chubut and Santa Cruz. On the table-lands and in the western section of Neuquen the falls of snow are more frequent and at times the ground is covered for several days, disappearing more rapidly from the valleys than from the heights. In the interior of Tierra del Fuego snow is found throughout the winter and at times falls, in small quantities, even in the summer months.

The following tables show the mean monthly precipitation for 41 stations, distributed by territories.

MEAN MONTHLY PRECIPITATION IN THE PATAGONIAN ZONE.

## Territory of Rio Negro.

| MONTH | Limay 1900 to 1907 | Chelforo 1899 to 1907 | Chichinales 1904 to 1907 | Choele Choel 1902 to 1907 | Conesa 1902 to 1907 | San Antonio 1899 to 1907 | Sierra Grande 1902 to 1907 | Cabo Alarcon 1902 to 1907 | Ñorquinco 1903 to 1907 |
|---|---|---|---|---|---|---|---|---|---|
| January | 4 | 16 | 13 | 22 | 34 | 17 | 51 | 10 | 5 |
| February | 2 | 4 | 6 | 10 | 23 | 9 | 35 | 15 | 8 |
| March | 7 | 20 | 10 | 19 | 12 | 23 | 51 | 3 | 26 |
| April | 5 | 29 | 8 | 34 | 56 | 34 | 32 | 5 | 24 |
| May | 16 | 29 | 40 | 32 | 28 | 34 | 120 | 24 | 35 |
| June | 21 | 29 | 16 | 19 | 25 | 23 | 23 | 33 | 133 |
| July | 14 | 6 | 13 | 10 | 10 | 20 | 36 | 18 | 41 |
| August | 28 | 5 | 1 | 7 | 4 | 7 | 8 | 5 | 26 |
| September | 14 | 12 | 5 | 12 | 12 | 14 | 13 | 21 | 28 |
| October | 16 | 17 | 18 | 15 | 25 | 12 | 23 | 6 | 10 |
| November | 16 | 12 | 24 | 10 | 10 | 7 | 12 | 6 | 1 |
| December | 15 | 12 | 12 | 22 | 16 | 5 | 14 | 8 | 10 |
| Year | 148 | 191 | 166 | 212 | 255 | 205 | 418 | 154 | 349 |

MEAN MONTHLY PRECIPITATION IN THE PATAGONIAN ZONE.

## Territory of Neuquen.

| MONTH | Chos Malal 1902 to 1907 | Tratayen 1902 to 1906 | Las Lajas 1902 to 1907 | L. Alumine 1903 to 1907 | M. Malal 1903 to 1907 | H. Lafquen 1903 to 1907 | Junin de los Andes 1901 to 1907 | San Martin de los Andes 1898 to 1904 | L. Traful 1905 to 1907 | Bariloche 1902 to 1907 |
|---|---|---|---|---|---|---|---|---|---|---|
| January | 2 | 21 | 6 | 27 | 39 | 26 | 10 | 49 | 21 | 49 |
| February | 7 | 29 | 10 | 22 | 27 | 19 | 16 | 45 | 14 | 39 |
| March | 17 | 21 | 2 | 28 | 72 | 19 | 32 | 98 | 22 | 58 |
| April | 19 | 3 | 14 | 81 | 157 | 81 | 72 | 145 | 88 | 67 |
| May | 29 | 18 | 12 | 145 | 190 | 148 | 129 | 311 | 201 | 296 |
| June | 57 | 23 | 64 | 221 | 299 | 268 | 183 | 196 | 204 | 140 |
| July | 42 | 12 | 47 | 167 | 310 | 210 | 177 | 510 | 133 | 147 |
| August | 52 | 11 | 19 | 68 | 211 | 124 | 58 | 158 | 110 | 87 |
| September | 16 | 28 | 20 | 120 | 179 | 109 | 59 | 146 | 69 | 92 |
| October | 28 | 17 | 15 | 86 | 110 | 76 | 25 | 121 | 107 | 64 |
| November | 11 | 3 | 4 | 21 | 20 | 21 | 11 | 71 | 2 | 15 |
| December | 15 | 13 | 13 | 41 | 42 | 44 | 16 | 40 | 37 | 34 |
| Year | 295 | 199 | 226 | 1,027 | 1,659 | 1,145 | 788 | 1,890 | 1,008 | 1,088 |

## Territory of Chubut.

| MONTH | Trelew 1880 to 1907 | Dos Pozos 1902 to 1907 | Cabo Raso 1902 to 1907 | Camarones 1902 to 1907 | C. Rivadavia 1903 to 1907 | Cholila 1903 to 1907 | 16 de Octubre 1896 to 1907 | C. San Martin 1905 to 1907 | Nueva Lubeca 1905 to 1907 | C. Sarmiento 1904 to 1907 | Valle Koslowsky 1900 to 1903 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| January | 33 | 6 | 10 | 2 | 4 | 3 | 13 | 6 | 4 | 12 | 12 |
| February | 27 | 17 | 4 | 4 | 5 | 12 | 16 | 12 | 10 | 6 | 18 |
| March | 38 | 15 | 22 | 10 | 12 | 29 | 28 | 34 | 13 | 25 | 72 |
| April | 44 | 19 | 19 | 24 | 17 | 32 | 64 | 32 | 26 | 16 | 30 |
| May | 80 | 78 | 36 | 35 | 33 | 56 | 77 | 36 | 128 | 17 | 54 |
| June | 82 | 36 | 72 | 52 | 28 | 83 | 83 | 87 | 19 | 9 | 70 |
| July | 47 | 50 | 52 | 18 | 49 | 77 | 68 | 57 | 10 | 38 | 66 |
| August | 56 | 13 | 12 | 1 | 11 | 157 | 66 | 9 | 10 | 17 | 78 |
| September | 40 | 4 | 11 | 92 | 6 | 47 | 31 | 19 | 36 | 8 | 43 |
| October | 22 | 0 | 3 | 12 | 7 | 12 | 18 | 11 | 1 | 4 | 11 |
| November | 47 | 5 | 4 | 6 | 11 | 6 | 16 | 10 | 2 | 14 | 22 |
| December | 44 | 7 | 12 | 4 | 14 | 6 | 11 | 6 | 1 | 4 | 10 |
| Year | 560 | 250 | 257 | 260 | 197 | 520 | 491 | 319 | 270 | 170 | 486 |

MEAN MONTHLY PRECIPITATION IN THE PATAGO IAN ZONE.

| MONTH | Territory of Santa Cruz. | | | | | | | | Tierra del Fuego. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Caleta Olivia 1904 to 1907 | C. Blanco 1902 to 1907 | Cañadon 1903 to 1907 | San Julian 1903 to 1907 | Santa Cruz 1903 to 1907 | P. Coyle 1903 to 1907 | R. Gallegos 1901 to 1907 | C. Virgenes 1903 to 1907 | Ushuaia 1896 to 1907 | P. Harberton 1903 to 1907 | Staten Island 1886 to 1893 — 1899 to 1900 |
| January | 5 | 6 | 2 | 18 | 12 | 16 | 26 | 23 | 46 | 47 | 139 |
| February | 7 | 6 | 20 | 19 | 7 | 12 | 26 | 16 | 63 | 46 | 169 |
| March | 24 | 11 | 27 | 23 | 5 | 23 | 48 | 22 | 59 | 34 | 151 |
| April | 42 | 29 | 12 | 21 | 15 | 21 | 20 | 78 | 38 | 34 | 155 |
| May | 30 | 80 | 16 | 85 | 18 | 52 | 48 | 24 | 34 | 38 | 167 |
| June | 15 | 16 | 30 | 30 | 9 | 22 | 58 | 38 | 58 | 50 | 170 |
| July | 69 | 50 | 21 | 40 | 29 | 48 | 30 | 18 | 36 | 32 | 124 |
| August | 22 | 15 | 50 | 16 | 9 | 22 | 17 | 19 | 24 | 23 | 127 |
| September | 6 | 2 | 15 | 14 | 4 | 8 | 13 | 29 | 37 | 22 | 95 |
| October | 5 | 11 | 17 | 5 | 10 | 8 | 27 | 33 | 43 | 27 | 109 |
| November | 9 | 2 | 7 | 12 | 10 | 5 | 34 | 29 | 51 | 30 | 123 |
| December | 18 | 22 | 85 | 28 | 25 | 31 | 57 | 18 | 58 | 44 | 172 |
| Year | 252 | 250 | 302 | 311 | 153 | 268 | 404 | 347 | 547 | 427 | 1,701 |

## WI D.

A.—*Frequency.* The prevailing direction of the wind in all the region to the south of the Rio Negro is W. or SW., as will be seen from the following tables, which show the normal frequency of the wind from each of the eight principal directions, as also the number of calms. The figures refer to the relative frequency per 1000, deduced from the tri-daily observations.

RELATIVE MONTHLY WIND FREQUENCY IN THE PATAGONIA ZONE.

| MONTH | Limay | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | N. | NE. | E. | SE. | S. | SW. | W. | NW. | Calm |
| January | 106 | 79 | 35 | 48 | 42 | 229 | 250 | 59 | 152 |
| February | 60 | 97 | 97 | 39 | 19 | 220 | 264 | 61 | 143 |
| March | 97 | 75 | 73 | 29 | 62 | 161 | 276 | 31 | 196 |
| April | 65 | 72 | 79 | 29 | 29 | 188 | 276 | 43 | 219 |
| May | 35 | 70 | 103 | 44 | 20 | 146 | 280 | 79 | 223 |
| June | 39 | 101 | 51 | 53 | 22 | 149 | 208 | 118 | 259 |
| July | 37 | 83 | 83 | 72 | 15 | 169 | 241 | 122 | 178 |
| August | 77 | 104 | 35 | 49 | 15 | 188 | 208 | 121 | 203 |
| September | 50 | 112 | 30 | 55 | 11 | 185 | 221 | 135 | 201 |
| October | 42 | 92 | 35 | 53 | 15 | 279 | 200 | 152 | 132 |
| November | 38 | 106 | 43 | 63 | 34 | 238 | 204 | 119 | 155 |
| December | 36 | 60 | 38 | 40 | 18 | 377 | 242 | 49 | 140 |
| Year | 57 | 88 | 58 | 48 | 25 | 211 | 239 | 91 | 183 |
| | San Antonio | | | | | | | | |
| January | 213 | 17 | 116 | 90 | 228 | 54 | 116 | 69 | 97 |
| February | 202 | 21 | 71 | 81 | 233 | 76 | 155 | 59 | 102 |
| March | 184 | 11 | 54 | 39 | 236 | 69 | 187 | 61 | 159 |
| April | 213 | 11 | 71 | 38 | 167 | 56 | 191 | 51 | 202 |
| May | 185 | 15 | 28 | 22 | 121 | 80 | 293 | 90 | 166 |
| June | 187 | 9 | 20 | 7 | 158 | 67 | 257 | 142 | 153 |
| July | 186 | 7 | 32 | 5 | 150 | 39 | 251 | 125 | 205 |
| August | 182 | 16 | 83 | 21 | 129 | 53 | 267 | 97 | 152 |
| September | 174 | 11 | 73 | 20 | 151 | 42 | 269 | 129 | 131 |
| October | 125 | 19 | 110 | 39 | 213 | 67 | 195 | 97 | 135 |
| November | 153 | 16 | 140 | 38 | 220 | 87 | 182 | 58 | 106 |
| December | 173 | 11 | 130 | 43 | 266 | 74 | 184 | 19 | 100 |
| Year | 182 | 14 | 77 | 37 | 189 | 64 | 212 | 83 | 142 |
| | Comodoro Rivadavia | | | | | | | | |
| January | 253 | 48 | 19 | 24 | 38 | 134 | 258 | 156 | 70 |
| February | 215 | 83 | 26 | 12 | 50 | 86 | 221 | 177 | 130 |
| March | 132 | 29 | 22 | 22 | 22 | 67 | 301 | 249 | 156 |
| April | 116 | 60 | 28 | 23 | 41 | 70 | 271 | 238 | 153 |
| May | 105 | 24 | 26 | 13 | 67 | 95 | 361 | 163 | 146 |
| June | 105 | 13 | 11 | 11 | 40 | 112 | 337 | 244 | 127 |
| July | 108 | 34 | 9 | 17 | 52 | 97 | 333 | 189 | 161 |
| August | 127 | 38 | 15 | 24 | 28 | 121 | 284 | 245 | 118 |
| September | 155 | 49 | 18 | 20 | 47 | 73 | 329 | 171 | 138 |
| October | 194 | 64 | 11 | 15 | 39 | 92 | 411 | 101 | 73 |
| November | 200 | 29 | 9 | 7 | 40 | 146 | 318 | 187 | 64 |
| December | 228 | 19 | 4 | 11 | 65 | 153 | 286 | 161 | 73 |
| Year | 162 | 41 | 16 | 17 | 44 | 104 | 309 | 190 | 117 |

RELATIVE MONTHLY WIND FREQUENCY IN THE PATAGONIAN ZONE.

| MONTH | N. | NE. | E. | SE. | S. | SW. | W. | NW. | Calm |
|---|---|---|---|---|---|---|---|---|---|
| | **Santa Cruz** | | | | | | | | |
| January | 64 | 15 | 60 | 69 | 97 | 217 | 196 | 112 | 170 |
| February | 69 | 17 | 31 | 24 | 111 | 222 | 224 | 106 | 196 |
| March | 38 | 16 | 16 | 19 | 89 | 102 | 408 | 156 | 156 |
| April | 93 | 27 | 27 | 20 | 138 | 91 | 289 | 122 | 193 |
| May | 56 | 19 | 11 | 32 | 86 | 70 | 368 | 156 | 202 |
| June | 64 | 29 | 18 | 27 | 53 | 167 | 273 | 131 | 238 |
| July | 75 | 32 | 32 | 22 | 140 | 144 | 230 | 108 | 217 |
| August | 88 | 13 | 51 | 24 | 56 | 127 | 241 | 110 | 290 |
| September | 76 | 13 | 29 | 36 | 82 | 184 | 251 | 107 | 222 |
| October | 75 | 17 | 17 | 52 | 120 | 271 | 207 | 43 | 198 |
| November | 42 | 29 | 38 | 36 | 93 | 267 | 287 | 64 | 144 |
| December | 52 | 19 | 47 | 67 | 97 | 215 | 213 | 69 | 221 |
| Year | 66 | 20 | 31 | 36 | 97 | 173 | 266 | 107 | 204 |
| | **Cabo de las Virgenes** | | | | | | | | |
| January | 38 | 21 | 21 | 11 | 70 | 592 | 129 | 102 | 16 |
| February | 76 | 23 | 0 | 29 | 29 | 550 | 123 | 117 | 53 |
| March | 150 | 11 | 21 | 11 | 54 | 527 | 108 | 97 | 21 |
| April | 128 | 61 | 56 | 33 | 45 | 211 | 222 | 33 | 211 |
| May | 50 | 36 | 43 | 54 | 136 | 351 | 158 | 50 | 122 |
| June | 89 | 33 | 7 | 22 | 115 | 248 | 304 | 56 | 126 |
| July | 60 | 54 | 41 | 88 | 104 | 199 | 302 | 76 | 76 |
| August | 68 | 29 | 26 | 50 | 26 | 147 | 361 | 132 | 161 |
| September | 76 | 17 | 24 | 24 | 50 | 264 | 331 | 128 | 86 |
| October | 101 | 34 | 26 | 14 | 67 | 195 | 373 | 101 | 89 |
| November | 83 | 48 | 10 | 7 | 100 | 288 | 326 | 67 | 71 |
| December | 65 | 35 | 51 | 21 | 65 | 326 | 308 | 78 | 51 |
| Year | 82 | 34 | 26 | 30 | 72 | 325 | 254 | 87 | 90 |
| | **Ushuaia** | | | | | | | | |
| January | 14 | 14 | 54 | 4 | 50 | 584 | 86 | 65 | 129 |
| February | 91 | 8 | 8 | 0 | 24 | 480 | 64 | 103 | 222 |
| March | 32 | 11 | 18 | 0 | 39 | 487 | 101 | 54 | 258 |
| April | 19 | 11 | 26 | 7 | 59 | 452 | 100 | 59 | 267 |
| May | 18 | 11 | 11 | 14 | 25 | 462 | 54 | 39 | 366 |
| June | 39 | 8 | 31 | 36 | 114 | 370 | 83 | 58 | 261 |
| July | 65 | 13 | 3 | 5 | 86 | 395 | 59 | 30 | 344 |
| August | 62 | 24 | 40 | 5 | 46 | 301 | 99 | 81 | 342 |
| September | 42 | 25 | 39 | 3 | 36 | 414 | 144 | 78 | 219 |
| October | 70 | 11 | 38 | 11 | 38 | 438 | 150 | 91 | 153 |
| November | 64 | 11 | 39 | 8 | 33 | 503 | 106 | 86 | 150 |
| December | 27 | 16 | 35 | 16 | 38 | 602 | 51 | 40 | 175 |
| Year | 45 | 14 | 29 | 9 | 49 | 457 | 91 | 65 | 241 |

To the monthly values which precede are added the annual frequency for 12 additional stations.

| STATION | N. | NE. | E. | SE. | S. | SW. | W. | NW. | Calm |
|---|---|---|---|---|---|---|---|---|---|
| Chos-Malal | 19 | 16 | 25 | 26 | 34 | 49 | 262 | 126 | 443 |
| Choele Choel | 159 | 97 | 65 | 58 | 105 | 100 | 156 | 132 | 128 |
| Nahuel Huapi | 14 | 18 | 55 | 33 | 14 | 47 | 421 | 147 | 251 |
| 16 de Octubre | 21 | 23 | 58 | 21 | 48 | 40 | 543 | 30 | 216 |
| Camarones | 96 | 29 | 40 | 58 | 150 | 172 | 184 | 52 | 219 |
| Buen Pasto | 32 | 22 | 8 | 12 | 17 | 170 | 379 | 98 | 262 |
| Puerto Deseado | 118 | 40 | 63 | 25 | 122 | 164 | 286 | 79 | 103 |
| Cañadon | 54 | 32 | 60 | 34 | 67 | 240 | 164 | 171 | 178 |
| San Julian | 107 | 73 | 35 | 33 | 111 | 253 | 155 | 73 | 160 |
| Puerto Coyle | 64 | 72 | 74 | 17 | 252 | 222 | 160 | 49 | 90 |
| Rio Gallegos | 80 | 46 | 19 | 15 | 65 | 437 | 138 | 59 | 141 |
| Staten Island | 114 | 36 | 12 | 67 | 152 | 160 | 152 | 246 | 61 |

B.—*Velocity*. The predominating W. and S W. winds of the Patagonian zone are in general strong and violent, especially on the Atlantic coast and the table-lands of the territories of Chubut and Santa Cruz. In the region of the foothills of the Cordilleras, especially in the valleys, their violence is less than near the coast, but the entire zone may be considered as subject to strong winds. The following table shows the mean monthly velocity in kilometres per hour, for six stations situated between Limay, in the confluence of the rivers Limay and Neuquen, and Staten Island.

MEAN MONTHLY VELOCITY OF THE WIND IN THE PATAGONIAN ZONE.

(IN KILOMETRES PER HOUR)

| MONTH | Limay | Bariloche | Sta. Cruz | Rio Gallegos | Ushuaia | Staten Island |
|---|---|---|---|---|---|---|
| January | 15.4 | 13.1 | 15.7 | 14.9 | 13.9 | 18.5 |
| February | 14.3 | 12.4 | 18.0 | 16.9 | 13.7 | 23.2 |
| March | 11.8 | 10.1 | 15.0 | 15.8 | 11.7 | 30.9 |
| April | 9.9 | 10.1 | 12.9 | 13.3 | 10.6 | 26.4 |
| May | 10.6 | 13.3 | 13.1 | 12.5 | 11.5 | 27.6 |
| June | 9.9 | 13.9 | 14.5 | 11.7 | 10.2 | 31.2 |
| July | 10.4 | 11.6 | 11.3 | 9.5 | 13.5 | 31.2 |
| August | 10.6 | 10.9 | 9.5 | 9.4 | 11.2 | 28.2 |
| September | 14.5 | 10.5 | 10.7 | 13.5 | 16.0 | 26.9 |
| October | 14.0 | 10.6 | 13.6 | 16.2 | 15.6 | 24.4 |
| November | 14.2 | 12.4 | 18.6 | 18.8 | 14.9 | 22.2 |
| December | 16.4 | 16.9 | 16.8 | 16.8 | 12.7 | 20.2 |
| Year | 12.7 | 12.2 | 14.1 | 14.1 | 12.9 | 25.9 |

We add the results of the observations made in Laurie Island, of the South Orkney group. This series began in March 1903, under the direction of Dr. W. S. Bruce, organizer and director of the Scottish Antarctic Expedition. At the beginning of 1904 the Scottish Commission was succeeded by the Argentine and since then meteorological and magnetic observations have been continued under the direction of this Office. The commissions are relieved every year in the month of January or February, since in these months the islands are free from the ice which surrounds them during the greater part of the year. The geographical situation of the station is 60°43' of latitude and 44°39' of longitude west of Greenwich. The height of the barometer is 7 metres above the mean level of the sea. The tables which follow give, in condensed form, a general summary of the observations to the month of March 1908, or a complete series for five years. The graphical expression of the annual variation of the barometric pressure, temperature, relative humidity and vapour pressure, is found in Plate No. XLI. The relative frequency of the winds is given in Plate XLII and the diurnal variation of the barometric pressure and temperature in Plate XLIII.

OBSERVATIONS IN THE SOUTH ORKNEY ISLANDS.

| MONTH | ATMOSPHERIC PRESSURE | | | | TEMPERATURE | | | | Sea Temperature |
|---|---|---|---|---|---|---|---|---|---|
| | Mean | Absol. Max. | Absol. Min. | Amplitude | Mean | Absol. Max. | Absol. Min. | Amplitude | |
| | mm. | mm. | mm. | mm. | ° | ° | ° | ° | ° |
| January | 741.1 | 759.7 | 721.4 | 38.3 | 0.3 | 6.9 | — 7.0 | 13.9 | —0.04 |
| February | 40.6 | 59.4 | 10.3 | 49.1 | 0.5 | 8.8 | — 6.0 | 14.8 | 0.14 |
| March | 39.6 | 58.7 | 17.8 | 40.9 | — 0.2 | 8.5 | —13.6 | 22.1 | —0.03 |
| April | 42.1 | 64.2 | 16.1 | 48.1 | — 3.4 | 6.5 | —22.3 | 28.8 | —0.81 |
| May | 41.2 | 61.7 | 15.2 | 46.5 | — 8.0 | 8.2 | —28.3 | 36.5 | —1.46 |
| June | 43.7 | 66.1 | 9.0 | 57.1 | —11.3 | 5.3 | —32.8 | 38.1 | —1.85 |
| July | 45.2 | 72.7 | 16.5 | 56.2 | —12.4 | 2.4 | —33.9 | 36.3 | —1.85 |
| August | 45.6 | 67.4 | 16.5 | 50.9 | — 9.7 | 4.3 | —40.1 | 44.4 | —1.85 |
| September | 42.7 | 70.4 | 15.3 | 55.1 | — 7.3 | 6.3 | —32.1 | 38.4 | —1.76 |
| October | 43.3 | 64.9 | 13.4 | 51.5 | — 4.4 | 5.6 | —31.2 | 36.8 | —1.66 |
| November | 40.7 | 63.6 | 16.6 | 47.0 | — 1.3 | 6.2 | —13.1 | 19.3 | —1.21 |
| December | 42.4 | 62.0 | 16.9 | 45.1 | — 0.8 | 5.7 | — 6.7 | 12.4 | —0.39 |
| Year | 742.3 | 772.7 | 709.0 | 63.7 | — 4.8 | 8.8 | —40.1 | 48.9 | —1.06 |

| MONTH | HUMIDITY | | SUNSHINE | | Cloudiness | PRECIPITATION | | Velocity of the wind in kms. per hour | |
|---|---|---|---|---|---|---|---|---|---|
| | Relative Humidity | Vapour Pressure | No. of Hours | Percentage of possible amount of sunshine | Scale of 100 | No. of Hours | Percentage | Mean | Max. |
| | | | | % | | | % | | |
| January..... | 85.0 | 4.07 | 51 | 11 | 94 | 179 | 24 | 14.4 | 73 |
| February... | 87.3 | 4.12 | 49 | 14 | 92 | 171 | 25 | 22.8 | 91 |
| March ....... | 88.8 | 4.04 | 33 | 11 | 92 | 223 | 30 | 26.1 | 98 |
| April......... | 88.7 | 3.22 | 35 | 14 | 86 | 197 | 27 | 26.6 | 111 |
| May.......... | 92.3 | 2.53 | 19 | 12 | 80 | 227 | 30 | 25.3 | 100 |
| June......... | 92.6 | 2.05 | 5 | 8 | 74 | 190 | 26 | 25.3 | 97 |
| July.......... | 93.9 | 1.87 | 18 | 12 | 73 | 190 | 26 | 22.1 | 100 |
| August...... | 94.3 | 2.32 | 46 | 21 | 76 | 185 | 24 | 24.1 | 108 |
| September.. | 92.5 | 2.60 | 76 | 25 | 78 | 2c6 | 29 | 25.3 | 95 |
| October..... | 89.7 | 3.05 | 66 | 15 | 88 | 219 | 30 | 25.7 | 116 |
| November.. | 89.5 | 3.75 | 60 | 13 | 91 | 231 | 32 | 23.8 | 86 |
| December... | 87.9 | 3.83 | 79 | 16 | 92 | 165 | 22 | 19.8 | 90 |
| Year...... | 90.2 | 3.12 | 537 | 15 | 85 | 2,383 | 27 | 23.4 | 116 |

RELATIVE FREQUENCY OF THE WINDS.

| MONTH | N. | NE. | E. | SE. | S. | SW. | W. | NW. |
|---|---|---|---|---|---|---|---|---|
| January.................... | 37 | 26 | 57 | 49 | 85 | 286 | 390 | 70 |
| February.................... | 110 | 77 | 17 | 40 | 75 | 211 | 333 | 137 |
| March....................... | 55 | 24 | 6 | 31 | 51 | 228 | 380 | 225 |
| April....................... | 31 | 18 | 10 | 42 | 119 | 363 | 286 | 131 |
| May......................... | 71 | 44 | 25 | 65 | 119 | 320 | 201 | 155 |
| June........................ | 80 | 45 | 11 | 11 | 142 | 294 | 297 | 120 |
| July........................ | 42 | 31 | 4 | 8 | 123 | 338 | 347 | 107 |
| August...................... | 70 | 28 | 7 | 31 | 150 | 292 | 264 | 158 |
| September.................. | 41 | 1 | 4 | 51 | 100 | 290 | 394 | 119 |
| October..................... | 108 | 24 | 13 | 14 | 96 | 217 | 329 | 199 |
| November................... | 92 | 54 | 56 | 67 | 53 | 178 | 285 | 215 |
| December.................. | 59 | 52 | 31 | 71 | 220 | 240 | 218 | 109 |
| Year................. | 66 | 35 | 22 | 40 | 111 | 271 | 310 | 145 |
| Summer.................... | 69 | 52 | 35 | 53 | 127 | 246 | 313 | 105 |
| Autumn..................... | 52 | 29 | 14 | 46 | 96 | 304 | 289 | 170 |
| Winter...................... | 64 | 35 | 7 | 17 | 138 | 308 | 303 | 128 |
| Spring...................... | 80 | 26 | 24 | 44 | 83 | 228 | 336 | 178 |

DIURNAL VARIATION BY SEASONS.

| HOUR | ATMOSPHERIC PRESSURE | | | | | TEMPERATURE | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Summer | Autumn | Winter | Spring | Year | Summer | Autumn | Winter | Spring | Year |
| | mm. | mm. | mm. | mm. | mm. | o | o | o | o | o |
| 1 a. m. | 741.58 | 741.09 | 744.95 | 742.35 | 742.49 | —0.44 | —3.96 | —11 16 | —4.90 | —5.13 |
| 2 | 1.49 | 1.06 | 4.97 | 2.28 | 2.45 | —0.45 | —3.97 | —11.18 | —4.94 | —5.15 |
| 3 | 1.45 | 0.97 | 4.92 | 2.33 | 2.42 | —0.47 | —3.93 | —11.10 | —5.00 | —5.14 |
| 4 | 1.50 | 0.92 | 4.85 | 2.35 | 2.40 | —0.44 | —3.88 | —11.09 | —5.01 | —5.12 |
| 5 | 1.58 | 0.93 | 4.87 | 2.37 | 2.44 | —0.35 | —3.90 | —11.20 | —4.96 | —5.11 |
| 6 | 1.67 | 0.94 | 4.89 | 2.42 | 2.48 | —0.26 | —3.94 | —11.19 | —4.86 | —5.07 |
| 7 | 1.70 | 0.96 | 4.92 | 2.48 | 2.52 | —0.11 | —3.91 | —11.38 | —4.70 | —5.04 |
| 8 | 1.69 | 1.06 | 5.07 | 2.51 | 2.58 | +0.06 | —3.91 | —11.41 | —4.45 | —4.94 |
| 9 | 1.66 | 1.15 | 5.15 | 2.53 | 2.62 | +0.22 | —3.89 | —11.41 | —4.18 | —4.83 |
| 10 | 1.63 | 1.15 | 5.14 | 2.48 | 2.60 | +0.33 | —3.84 | —11.29 | —3.97 | —4.70 |
| 11 | 1.61 | 1.15 | 5.13 | 2.46 | 2.59 | +0.50 | —3.76 | —11.12 | —3.78 | —4.55 |
| Noon | 1.62 | 1.15 | 5.07 | 2.43 | 2.57 | +0.60 | —3.67 | —10.98 | —3.60 | —4.43 |
| 1 p.m. | 1.63 | 1.11 | 4.99 | 2.39 | 2.53 | +0.66 | —3.63 | —10.87 | —3.54 | —4.36 |
| 2 | 1.64 | 1.12 | 4.91 | 2.38 | 2.51 | +0.64 | —3.64 | —10.96 | —3.53 | —4.38 |
| 3 | 1.63 | 1.16 | 4.87 | 2.35 | 2.50 | +0.59 | —3.68 | —11.07 | —3.59 | —4.45 |
| 4 | 1.65 | 1.22 | 4.93 | 2.35 | 2.54 | +0.46 | —3.80 | —11.15 | —3.72 | —4.56 |
| 5 | 1.72 | 1.35 | 4.99 | 2.39 | 2.61 | +0.25 | —3.85 | —11.20 | —3.94 | —4.70 |
| 6 | 1.77 | 1.41 | 5.06 | 2.45 | 2.67 | +0.11 | —3.91 | —11.17 | —4.14 | —4.79 |
| 7 | 1.84 | 1.46 | 5.08 | 2.50 | 2.72 | —0.07 | —3.93 | —11.15 | —4.28 | —4.87 |
| 8 | 1.85 | 1.45 | 5.11 | 2.53 | 2.74 | —0.16 | —3.98 | —11.17 | —4.38 | —4.93 |
| 9 | 1.81 | 1.45 | 5.09 | 2.51 | 2.72 | —0.26 | —3 97 | —11.21 | —4.44 | —4.98 |
| 10 | 1.75 | 1.39 | 5.07 | 2.43 | 2.66 | —0.34 | —3.93 | —11.26 | —4.53 | —5.03 |
| 11 | 1.72 | 1.33 | 5.04 | 2.36 | 2.61 | —0.38 | —4.02 | —11.27 | —4.64 | —5.08 |
| Midnight | 1.65 | 1.24 | 5.04 | 2.34 | 2.56 | —0.41 | —4.04 | —11.27 | —4.71 | —5.12 |
| Day..... | 741.66 | 741.18 | 745.01 | 742.41 | 742.56 | +0.01 | —3.87 | —11.18 | —4.33 | —4.85 |

DIURNAL VARIATION OF THE RELATIVE HUMIDITY.

| HOUR | Summer | Autumn | Winter | Spring | Year | HOUR | Summer | Autumn | Winter | Spring | Year |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 a. m. | 82.2 | 90.4 | 94.1 | 91.6 | 91.1 | 1 p. m. | 84.5 | 89.2 | 93.2 | 89.4 | 89.1 |
| 2 | 87.8 | 90.5 | 93.6 | 92.0 | 91.0 | 2 | 84.1 | 88.7 | 93.7 | 89.5 | 89.0 |
| 3 | 87.8 | 90.4 | 93.8 | 92.0 | 91.0 | 3 | 84.7 | 88.8 | 93.7 | 89.5 | 89.2 |
| 4 | 87.5 | 90.4 | 93.8 | 91.3 | 90.8 | 4 | 84.9 | 89.0 | 93.9 | 90.1 | 89.5 |
| 5 | 87.8 | 91.1 | 93.7 | 91.3 | 91.0 | 5 | 86.4 | 89.6 | 94.0 | 90.1 | 90.0 |
| 6 | 87.4 | 91.0 | 93.6 | 90.9 | 90.7 | 6 | 86.4 | 89.6 | 93.3 | 90.4 | 89.9 |
| 7 | 87.2 | 90.8 | 93.9 | 90.0 | 90.5 | 7 | 87.2 | 89.4 | 92.9 | 90.4 | 90.0 |
| 8 | 86.8 | 90.8 | 93.8 | 90.1 | 90.4 | 8 | 87.6 | 89.6 | 93.5 | 90.9 | 90.4 |
| 9 | 86.1 | 90.3 | 93.9 | 89.7 | 90.0 | 9 | 88.0 | 90.0 | 93.0 | 91.0 | 90.5 |
| 10 | 85.5 | 89.9 | 93.7 | 90.0 | 89.8 | 10 | 88.2 | 90.1 | 93.4 | 91.3 | 90.8 |
| 11 | 85.1 | 89.2 | 93.9 | 89.6 | 89.4 | 11 | 88.5 | 90.7 | 93.4 | 91.3 | 91.0 |
| Noon | 84.7 | 88.7 | 93.3 | 89.3 | 89.0 | Midnight | 88.8 | 90.8 | 93.4 | 91.5 | 91.1 |
| | | | | | | Day..... | 86.7 | 90.0 | 93.6 | 90.6 | 90.2 |

## HYDROMETRIC SECTION.

The Hydrometric Section of the Meteorological Office was created in August 1902 and under the immediate direction of Engineer Gunardo Lange. The principal object of the service at that time was to continue the studies, begun in 1899 by Engineer Cesar Cipolletti, for the control and irrigation in the region of the sources of the Negro and Colorado rivers.

Once the hydrometric gauges had been installed at the sources of these rivers and the regular service established, it was decided to extend the work of the Section to the more important rivers of the Republic. This service has developed so rapidly that, at the present time, all the principal rivers of the country, from the Santa Cruz to the Pilcomayo, are under constant systematic observation.

Hydrometric gauges have been installed at suitable points in the tributaries to the large rivers and the flow corresponding to the different water heights at the observation points has been determined.

From these data the flow of the river is calculated and the results are recorded in tables, also graphically.

The service includes preliminary surveys of regions suitable to works for controlling the natural flow of the rivers in order to utilise the water for navigation, irrigation and motive power, the study including levelling and general topographical work.

The Section is advised telegraphically each day of the height of the water in the Paraguay, Parana, Uruguay, La Plata and Negro rivers and their tributaries, from stations where telegraph offices exist. These data, together with the corresponding depth of water at the principal bars in the navigable rivers, are published in the daily weather map of the Office. Wherever the telegraph lines permit, the service also gives warning of floods and any extraordinary changes in the height of the water.

Complete data for each point of observation are kept in the archives of the Section, including the annual hygrometric observation registers, tables with their corresponding curves, and a large number of maps, plans and drawings of the interesting points and regions.

Of the various reports prepared by the Chief of the Section, the following have been published:—

«Hydrometric Study of the Rio Negro and its Affluents», 1904.

«The Great Flood of 1905 in the Parana River and its Affluents».

Also by special authority:

«A Study of the Pilcomayo River», 1905-6.

«Report of the Subsoil near the Outlet of Lake Nahuel Huapi .

A map of the Republic is appended giving the location of the hydrometric stations.

The following synoptic table gives the flow of the rivers and lakes forming the Rio Negro drainage system, derived from observations made during the years 1902-7.

# BASIN OF THE RIO NEGRO

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## Synoptic Table of the Flow of the Rivers and Lakes

# BASIN OF THE

## Synoptic Table of the

| LAKE OR RIVER | YEAR | JAN. | | FEB. | | MARCH | | APRIL | | MAY | | JUNE | | JULY | | AUG. | | SEPT. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean height at low water | Mean flow m.³ | Mean height at low water | Mean flow m.³ | Mean height at low water | Mean flow m.³ | Mean height at low water | Mean flow m.³ | Mean height at low water | Mean flow m.³ | Mean height at low water | Mean flow m.³ | Mean height at low water | Mean flow m.³ | Mean height at low water | Mean flow m.³ | Mean height at low water | Mean flow m.³ |
| | | m | | m | | m | | m | | m | | m | | m | | m | | m | |
| Lake | 1902 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Nahuel Huapi | 1903 | 1.47 | 240 | 0.79 | 143 | 0.25 | 75 | 0.25 | 75 | 0.61 | 120 | 0.70 | 132 | 0.77 | 139 | 0.75 | 137 | 1.11 | 185 |
| (Outlet) | 1904 | 1.07 | 180 | 0.81 | 147 | 0.74 | 134 | 0.79 | 140 | 1.20 | 200 | 1.66 | 286 | 2.53 | 533 | 2.74 | 619 | 2.11 | 396 |
| Area with the three | 1905 | 1.69 | 287 | 0.88 | 152 | 0.56 | 116 | 0.43 | 106 | 0.81 | 140 | 1.14 | 180 | 1.25 | 200 | 1.50 | 248 | 1.53 | 251 |
| secondary lakes | 1906 | 1.45 | 235 | 0.97 | 167 | 0.60 | 119 | 0.68 | 128 | 1.23 | 200 | 2.19 | 384 | 2.00 | 361 | 1.64 | 274 | 1.34 | 208 |
| 627 km.² | 1907 | 0.87 | 149 | 0.56 | 116 | 0.37 | 100 | 0.08 | 75 | 0.09 | 74 | 0.81 | 146 | 0.86 | 148 | 0.81 | 146 | 0.85 | 146 |
| | Mean | 1.31 | 218 | 0.80 | 145 | 0.50 | 109 | 0.44 | 104 | 0.79 | 147 | 1.30 | 226 | 1.48 | 276 | 1.49 | 285 | 1.39 | 237 |
| | 1903 | 0.86 | 51 | 0.50 | 22 | 0.37 | 16 | 0.29 | 12 | 0.28 | 13 | 0.48 | 21 | 0.50 | 22 | 0.78 | 21 | 0.82 | 49 |
| Lake Traful | 1904 | 0.47 | 21 | 0.24 | 10 | 0.27 | 8 | 0.33 | 14 | 0.80 | 47 | 0.83 | 49 | 1.39 | 118 | 1.06 | 75 | 0.78 | 44 |
| (Outlet) | 1905 | 0.79 | 45 | 0.42 | 18 | 0.24 | 10 | 0.26 | 11 | 0.38 | 16 | 0.61 | 32 | 0.79 | 46 | 0.84 | 50 | 0.79 | 44 |
| Area | 1906 | 0.73 | 40 | 0.42 | 18 | 0.24 | 10 | 0.43 | 18 | 0.87 | 53 | 1.27 | 103 | 0.87 | 52 | 0.71 | 37 | 0.69 | 35 |
| 74 km.² | 1907 | 0.51 | 18 | 0.35 | 13 | 0.27 | 8 | 0.05 | 5 | 0.03 | 5 | 0.57 | 26 | 0.44 | 20 | 0.47 | 19 | 0.52 | 22 |
| | Mean | 0.76 | 35 | 0.39 | 15 | 0 28 | 10 | 0.27 | 12 | 0.48 | 27 | 0.75 | 46 | 0.80 | 51 | 0.71 | 40 | 0.72 | 39 |
| | 1903 | 0.59 | 27 | 0.36 | 14 | 0.22 | 9 | 0.18 | 7 | 0.22 | 9 | 0.65 | 38 | 0.50 | 23 | 0.50 | 23 | 0.86 | 52 |
| Lake Lolog | 1904 | 0.36 | 20 | 0.13 | 6 | 0.13 | 7 | 0.35 | 20 | 0.80 | 47 | 0.79 | 45 | 1.52 | 115 | 0.87 | 54 | 0.80 | 48 |
| (Outlet) | 1905 | 0.59 | 32 | 0.28 | 10 | 0.18 | 7 | 0.24 | 8 | 0.42 | 29 | 0.83 | 51 | 0.78 | 46 | 0.86 | 51 | 0.71 | 39 |
| Area | 1906 | 0.54 | 26 | 0.31 | 12 | 0.18 | 7 | 0.36 | 14 | 0.96 | 65 | 1.04 | 67 | 0.86 | 52 | 0.71 | 39 | 0.66 | 34 |
| 36 km.² | 1907 | 0.35 | 14 | 0.25 | 9 | 0.14 | 6 | 0.04 | 5 | 0.03 | 6 | 0.68 | 34 | 0.40 | 16 | 0.54 | 29 | 0.59 | 25 |
| | Mean | 0.49 | 24 | 0.27 | 10 | 0.17 | 7 | 0.23 | 11 | 0.49 | 31 | 0.79 | 47 | 0 81 | 50 | 0.69 | 38 | 0.72 | 40 |
| | 1903 | 0.68 | 76 | 0.55 | 63 | 0.40 | 41 | 0.34 | 33 | 0.38 | 37 | 0.74 | 91 | 0.65 | 75 | 0.62 | 71 | 0.99 | 131 |
| Lake | 1904 | 0.53 | 58 | 0.34 | 32 | 0.28 | 28 | 0.42 | 44 | 0.88 | 112 | 0.85 | 108 | 1.81 | 299 | 1.22 | 173 | 0.94 | 124 |
| Huechu Lafquen | 1905 | 0.80 | 99 | 0.44 | 45 | 0.33 | 28 | 0.40 | 41 | 0.53 | 57 | 0.95 | 126 | 1.07 | 139 | 1.05 | 141 | 0.87 | 109 |
| Area | 1906 | 0.67 | 79 | 0.48 | 49 | 0.34 | 28 | 0.54 | 59 | 1.17 | 169 | 1.46 | 222 | 1.07 | 144 | 0.86 | 140 | 0.74 | 88 |
| 97 km.² | 1907 | 0.44 | 44 | 0.22 | 26 | 0.27 | 25 | 0.19 | 18 | 0.24 | 23 | 0.76 | 91 | 0.61 | 68 | 0.59 | 67 | 0.68 | 87 |
| | Mean | 0.54 | 71 | 0.40 | 43 | 0.32 | 30 | 0.37 | 39 | 0.64 | 79 | 0.95 | 127 | 1.04 | 145 | 0.86 | 118 | 0.84 | 107 |
| | 1902 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| | 1903 | 1.75 | 595 | 1.20 | 370 | 0.92 | 271 | 0.90 | 268 | 1.00 | 300 | 1 49 | 490 | 1.50 | 468 | 1.40 | 438 | 2.04 | 772 |
| River Limay | 1904 | 1.22 | 372 | 0.92 | 270 | 0.82 | 245 | 1.25 | 384 | 1.86 | 560 | 2.07 | 710 | 3.72 | 2017 | 2.77 | 1221 | 2.61 | 1136 |
| Paso Limay | 1905 | 1.84 | 621 | 1.33 | 350 | 1.22 | 300 | 1.16 | 290 | 1.23 | 300 | 2.04 | 680 | 2.33 | 1120 | 2.33 | 1100 | 1.75 | 600 |
| | 1906 | 1.10 | 300 | 1.29 | 394 | 0.97 | 281 | 1.17 | 300 | 2.16 | 849 | 2.98 | 1560 | 2.69 | 1300 | 1.98 | 670 | 1.84 | 665 |
| | 1907 | 0.54 | 184 | 0.35 | 160 | 0.18 | 152 | 0.13 | 147 | 0.11 | 150 | 1.25 | 376 | 1.21 | 385 | 0.61 | 200 | 1.70 | 500 |
| | Mean | 1.29 | 414 | 1.01 | 308 | 0.82 | 249 | 0 92 | 277 | 1.27 | 431 | 1.96 | 761 | 2.29 | 1056 | 1.81 | 725 | 1.98 | 735 |
| | 1902 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| River | 1903 | 1.28 | 513 | 0.77 | 196 | 0.61 | 115 | 0.61 | 119 | 0.48 | 101 | 0 63 | 126 | 0.61 | 112 | 0.61 | 115 | 0.99 | 298 |
| Neuquen | 1904 | 0.70 | 151 | 0.49 | 116 | 0.40 | 99 | 0.45 | 106 | 1.29 | 538 | 1.32 | 550 | 1.95 | 1172 | 1.25 | 491 | 1.38 | 636 |
| Bridge of | 1905 | 1.49 | 700 | 0.95 | 271 | 0.70 | 158 | 0.55 | 129 | 0.82 | 245 | 1.63 | 850 | 1.58 | 789 | 1.15 | 434 | 1.02 | 350 |
| the Southern Rly. | 1906 | 1.48 | 684 | 0.72 | 159 | 0.28 | 93 | 0.21 | 96 | 0.47 | 134 | 1.10 | 445 | 1.12 | 447 | 0 94 | 237 | 0.80 | 202 |
| | 1907 | 0.55 | 133 | 0.18 | 86 | 0.11 | 80 | 0.20 | 85 | 0.24 | 90 | 0.26 | 90 | 0.16 | 82 | 0.51 | 102 | 0.96 | 289 |
| | Mean | 1.10 | 436 | 0.62 | 165 | 0.42 | 109 | 0.40 | 101 | 0.66 | 221 | 0.98 | 412 | 1.08 | 520 | 0.89 | 275 | 1.03 | 355 |
| | 1903 | 1.88 | 1100 | 1.21 | 530 | 0.81 | 350 | 0.81 | 378 | 0.86 | 394 | 1.25 | 645 | 1.26 | 603 | 1.22 | 570 | 1.92 | 1161 |
| | 1904 | 1.20 | 527 | 0.74 | 362 | 0.56 | 325 | 0.80 | 400 | 1.76 | 1048 | 1.95 | 1199 | 3.45 | 3010 | 2.41 | 1650 | 2.34 | 1597 |
| River Negro | 1905 | 1.92 | 1161 | 1.17 | 547 | 0.81 | 378 | 0.70 | 354 | 1.01 | 469 | 2.05 | 1308 | 2.69 | 1991 | 2.36 | 1601 | 2.04 | 1266 |
| Paso de Pizarro | 1906 | 1.59 | 855 | 1.10 | 497 | 0.69 | 346 | 0.78 | 384 | 1.69 | 923 | 2.75 | 2113 | 2.33 | 1625 | 1.46 | 772 | 1.60 | 866 |
| | 1907 | 0.80 | 309 | 0.48 | 227 | 0.28 | 213 | 0.05 | 207 | 0.05 | 207 | 0.94 | 427 | 0.89 | 390 | 0.66 | 264 | 1.34 | 654 |
| | Mean | 1.47 | 790 | 0.94 | 430 | 0.63 | 322 | 0.62 | 344 | 1.07 | 590 | 1.78 | 1138 | 2.12 | 1503 | 1.66 | 973 | 1.84 | 1108 |

# RIO NEGRO.

## Flow of the Rivers and Lakes.

| OCT | | NOV. | | DEC. | | YEAR | | MAXIMUM | | | | | | MINIMUM | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean height at low water | Mean flow m.³ | Mean height at low water | Mean flow m.³ | Mean height at low water | Mean flow m.³ | Mean height at low water | Mean flow m.³ | Date | Mean at low water | Mean m.³ | Date | Mean at low water | Mean m.³ | Date | Mean at low water | Mean m.³ | Date | Mean at low water | Mean m.³ |
| m | | m | | m | | m | | | m | | | | | | m | | | m | |
| — | — | — | — | 1.62 | 270 | — | — | | | | | | | | | | | | |
| 1.45 | 235 | 1.22 | 200 | 1.34 | 212 | 0.89 | 157 | 26/6 | 0.98 | 160 | 2/10 | 1.60 | 270 | 15/4 | 0.00 | 60 | 6/8 | 0.72 | 130 |
| 2.35 | 477 | 2.01 | 371 | 1.90 | 337 | 1.66 | 318 | 28/7 | 3.25 | 840 | 3/10 | 2.65 | 580 | 24/2 | 0.64 | 123 | 19/9 | 1.68 | 285 |
| 1.75 | 302 | 1.84 | 318 | 1.81 | 314 | 1.27 | 217 | 15/7 | 1.34 | 210 | 17/10 | 1.96 | 350 | 16/4 | 0.01 | 75 | 3/8 | 1.10 | 175 |
| 1.40 | 258 | 1.53 | 249 | 1.24 | 199 | 1.35 | 231 | 11/6 | 2.53 | 535 | 8/11 | 1.60 | 270 | 28/3 | 0.56 | 120 | 24/9 | 1.21 | 190 |
| 0.79 | 141 | 1.16 | 188 | 1.53 | 246 | 0.76 | 139 | 26/6 | 1.08 | 175 | 29/12 | 1.69 | 285 | 29/4 | 0.07 | 65 | 18/10 | 0.74 | 135 |
| 1.54 | 283 | 1.55 | 265 | 1.57 | 268 | 1.18 | 212 | | | | | | | | | | | | |
| 0.73 | 39 | 0.85 | 52 | 0.74 | 42 | 0.57 | 30 | 18/6 | 0.60 | 27 | 18/9 | 1.05 | 70 | 9/4 | 0.25 | 10 | 1/8 | 0.45 | 20 |
| 1.06 | 66 | 1.03 | 70 | 1.15 | 85 | 0.78 | 50 | 24/7 | 1.80 | 175 | 4/12 | 1.32 | 100 | 13/3 | 0.10 | 5 | 15/9 | 0.70 | 35 |
| 1.08 | 78 | 1.11 | 80 | 1.02 | 69 | 0.68 | 39 | 29/6 | 1.02 | 65 | 16/10 | 1.30 | 100 | 10/4 | 0.15 | 7 | 1/8 | 0.57 | 25 |
| 0.95 | 60 | 0.97 | 63 | 0.71 | 38 | 0.74 | 35 | 8/6 | 1.65 | 150 | 23/10 | 1.10 | 75 | 7/3 | 0.22 | 10 | 30/8 | 0.65 | 30 |
| 1.09 | 72 | 1.01 | 63 | 0.75 | 39 | 0.50 | 26 | 20/6 | 0.75 | 39 | 1/10 | 1.20 | 86 | 16/4 | 0.03 | 6 | 12/8 24/8 | 0.45 | 18 |
| 0.98 | 63 | 0.99 | 65 | 0.89 | 54 | 0.65 | 36 | | | | | | | | | | | | |
| 0.73 | 41 | 0.74 | 42 | 0.57 | 28 | 0.51 | 26 | 17/6 | 1.01 | 56 | 17/9 | 1.12 | 77 | 2/4 | 0.15 | 6 | 4/8 | 0.44 | 19 |
| 1.14 | 74 | 0.94 | 60 | 0.89 | 56 | 0.72 | 46 | 24/7 | 2.02 | 168 | 3/10 | 1.53 | 118 | 27/2 | 0.08 | 6 | 16/9 | 0.60 | 30 |
| 1.07 | 71 | 0.96 | 61 | 0.80 | 48 | 0.65 | 37 | 30/6 | 1.25 | 90 | 15/10 | 1.45 | 110 | 9/4 | 0.01 | 3 | 22/7 | 0.57 | 28 |
| 0.88 | 54 | 0.83 | 48 | 0.58 | 29 | 0.66 | 37 | 9/6 | 1.58 | 122 | 17/10 | 1.03 | 68 | 30/3 | 0.15 | 6 | 19/9 | 0.58 | 28 |
| 0.69 | 43 | 0.99 | 51 | 0.81 | 48 | 0.46 | 24 | 14/6 | 1.00 | 65 | 16/11 | 1.04 | 69 | 1/5 | 0.00 | 3 | 3/7 | 0.39 | 15 |
| 0.90 | 57 | 0.89 | 52 | 0.73 | 42 | 0.60 | 34 | | | | | | | | | | | | |
| 0.94 | 122 | 0.83 | 104 | 0.72 | 85 | 0.65 | 77 | 21/6 | 1.05 | 130 | 22/9 | 1.15 | 150 | 20/4 | 0.30 | 30 | 3/8 | 0.53 | 55 |
| 1.32 | 194 | 1.03 | 139 | 1.09 | 140 | 0.89 | 121 | 26/7 | 2.28 | 400 | 8/10 | 1.67 | 250 | 10/4 | 0.23 | 25 | 17/9 | 0.72 | 80 |
| 1.28 | 182 | 1.09 | 148 | 0.98 | 129 | 0.82 | 103 | 30/6 | 1.45 | 205 | 17/10 | 1.63 | 240 | 10/4 | 0.25 | 25 | 3/10 | 0.80 | 90 |
| 1.00 | 164 | 0.98 | 128 | 0.67 | 75 | 0.83 | 112 | 8/6 | 2.05 | 340 | 8/11 | 1.15 | 150 | 26/3 | 0.27 | 25 | 18/9 | 0.66 | 70 |
| 0.79 | 99 | 1.02 | 137 | 0.87 | 124 | 0.55 | 67 | 19/6 | 0.97 | 130 | 13/11 | 1.09 | 148 | 1/5 | 0.13 | 13 | 14/7 | 0.48 | 50 |
| 1.06 | 152 | 0.99 | 131 | 0.86 | 110 | 0.74 | 96 | | | | | | | | | | | | |
| — | — | 2.37 | 957 | 2.34 | 928 | — | — | | | | | | | | | | | | |
| 1.98 | 731 | 1.93 | 703 | 1.63 | 519 | 1.56 | 494 | 20/6 | 1.94 | 700 | 16/9 | 2.67 | 1140 | 30/3 | 0.92 | 240 | 1/8 | 1.40 | 420 |
| 2.92 | 1350 | 2.75 | 1180 | 2.54 | 1056 | 2.12 | 874 | 24/7 | 5.54 | 3590 | 25/9 | 3.89 | 2130 | 3/3 | 0.80 | 240 | 16/9 | 2.19 | 840 |
| 2.84 | 1300 | 2.78 | 1213 | 2.29 | 902 | 1.92 | 731 | 9/8 | 3.04 | 1390 | 13/10 | 4.09 | 2350 | 14/4 17/4 | 1.06 | 325 | 29/9 | 1.64 | 540 |
| 2.38 | 986 | 2.01 | 745 | 0.97 | 289 | 1.96 | 694 | 6/6 | 5.59 | 3590 | 21/10 | 2.84 | 1850 | 3/4 | 0.89 | 255 | 25/9 | 1.37 | 425 |
| 1.13 | 300 | 2.00 | 700 | 1.80 | 600 | 0.92 | 321 | 28/6 | 1.55 | 500 | 25/11 | 2.84 | 1250 | 30/4 | 0.00 | 145 | 15/7 | 1.01 | 300 |
| 2.25 | 933 | 2.30 | 916 | 1.94 | 715 | 1.75 | 622 | | | | | | | | | | | | |
| 1.47 | 679 | 1.46 | 704 | 1.65 | 896 | — | — | | | | | | | | | | | | |
| 1.04 | 343 | 1.34 | 554 | 1.00 | 326 | 0.83 | 243 | 22/6 | 0.82 | 230 | 1/11 | 1.50 | 690 | 9/5 | 0.27 | 90 | 13/8 | 0.55 | 100 |
| 1.49 | 697 | 1.74 | 917 | 1.88 | 1035 | 1.18 | 542 | 16/6 | 3.25 | 2900 | 5/12 | 2.30 | 1525 | 8/3 | 0.35 | 94 | 17/8 | 1.04 | 355 |
| 1.54 | 738 | 1.80 | 904 | 1.73 | 901 | 1.25 | 538 | 20/6 | 2.95 | 2400 | 14/10 | 2.65 | 1970 | 14/4 | 0.43 | 100 | 1/9 | 0.78 | 215 |
| 1.46 | 672 | 1.84 | 996 | 1.25 | 501 | 0.96 | 388 | 18/8 | 2.29 | 1510 | 5/11 | 2.21 | 1420 | 19/4 | 0.01 | 70 | 10/9 | 0.69 | 180 |
| 1.36 | 570 | 1.60 | 833 | 1.16 | 422 | 0.62 | 246 | 14/6 | 0.65 | 102 | 13/11 | 2.07 | 1200 | 23/2 | 0.00 | 80 | 6/7 | 0.10 | 80 |
| 1.37 | 614 | 1.66 | 816 | 1.44 | 637 | 0.98 | 391 | | | | | | | | | | | | |
| 1.86 | 1093 | 1.97 | 1218 | 1.62 | 877 | 1.38 | 741 | 19/6 | 1.68 | 930 | 17/9 | 2.33 | 1590 | — | — | — | 10/8 | 1.08 | 490 |
| 2.75 | 2034 | 2.57 | 1840 | 2.53 | 1786 | 1.92 | 1282 | 25/7 | 4.65 | 4900 | 26/9 | 3.54 | 3090 | 15/3 | 0.38 | 300 | 16/9 | 2.00 | 1240 |
| 2.62 | 1870 | 2.62 | 2000 | 2.17 | 1398 | 1.78 | 1195 | 1/7 | 3.64 | 3240 | 15/10 | 3.83 | 3520 | 16/3 | 0.52 | 380 | 30/9 | 1.87 | 1210 |
| 2.29 | 1526 | 2.34 | 1570 | 1.54 | 822 | 1.68 | 1025 | 9/6 | 4.28 | 4260 | 4/11 | 2.92 | 2250 | 6/4 | 0.58 | 365 | 30/8 | 0.87 | 400 |
| 1.47 | 750 | 2.22 | 1457 | 1.72 | 965 | 0.90 | 505 | 15/6 | 1.39 | 685 | 13/11 | 2.67 | 1930 | 11/5 | 0.00 | 205 | 18/8 | 0.39 | 225 |
| 2.19 | 1454 | 2.34 | 1617 | 1.91 | 1169 | 1.53 | 950 | | | | | | | | | | | | |

## MAGNETIC SECTION.

This branch of the service of the Meteorological Office was organised in 1903 and began work about the end of that year under the direction of Mr. Louis G. Schultz.

The first work consisted in a magnetic reconnaissance of the central part of the Republic to determine on a site for the magnetic observatory, as free as possible from influences which might disturb the investigation of the relation between magnetic and meteorological phenomena, also as a suitable reference point for the making of an isogonic chart of the country. As a result of this investigation the town of Pilar in the province of Cordoba was chosen for the establishment of the central observatory. The site chosen is situated near the bank of the Rio Segundo at some distance from the railway station and out of reach of the disturbing influences of heavy traffic. The buildings for the magnetic instruments were erected the following year. In one of them were installed the apparatus for the determination of the absolute constants, and in the other, variometers for photographic records of the elements. A complete meteorological installation was also provided.

During the next few years the instrumental equipment was increased by installing, in suitable structures, instruments for studying atmospheric electricity, solar spots and prominences, and seismic movements.

Early in 1904 a systematic determination of the magnetic constants was begun by establishing a series of stations distributed over the greater part of the Republic. During the present year the values of the elements have been re-determined at nearly all the stations established four years ago. Comparing these results with those obtained from the variometers, the declination values corresponding to the epoch January 1st, 1908, have been determined. They are shown in chart XLIV. In the following table are given the data from which the isogonic lines on the map were drawn. In order to check the position of the lines along the coast, comparisons have been made with the observations taken on board vessels provided with a special equipment for magnetic work. The values for Montevideo and the Brazilian stations depend on the observations made by the «Comision Bra ileña».

The annual change, entered in the following table, is deduced from the period 1904 to 1908. The geographical coordinates given correspond to points where the observations were made, this point always lying in the open country at some distance from the centres of population.

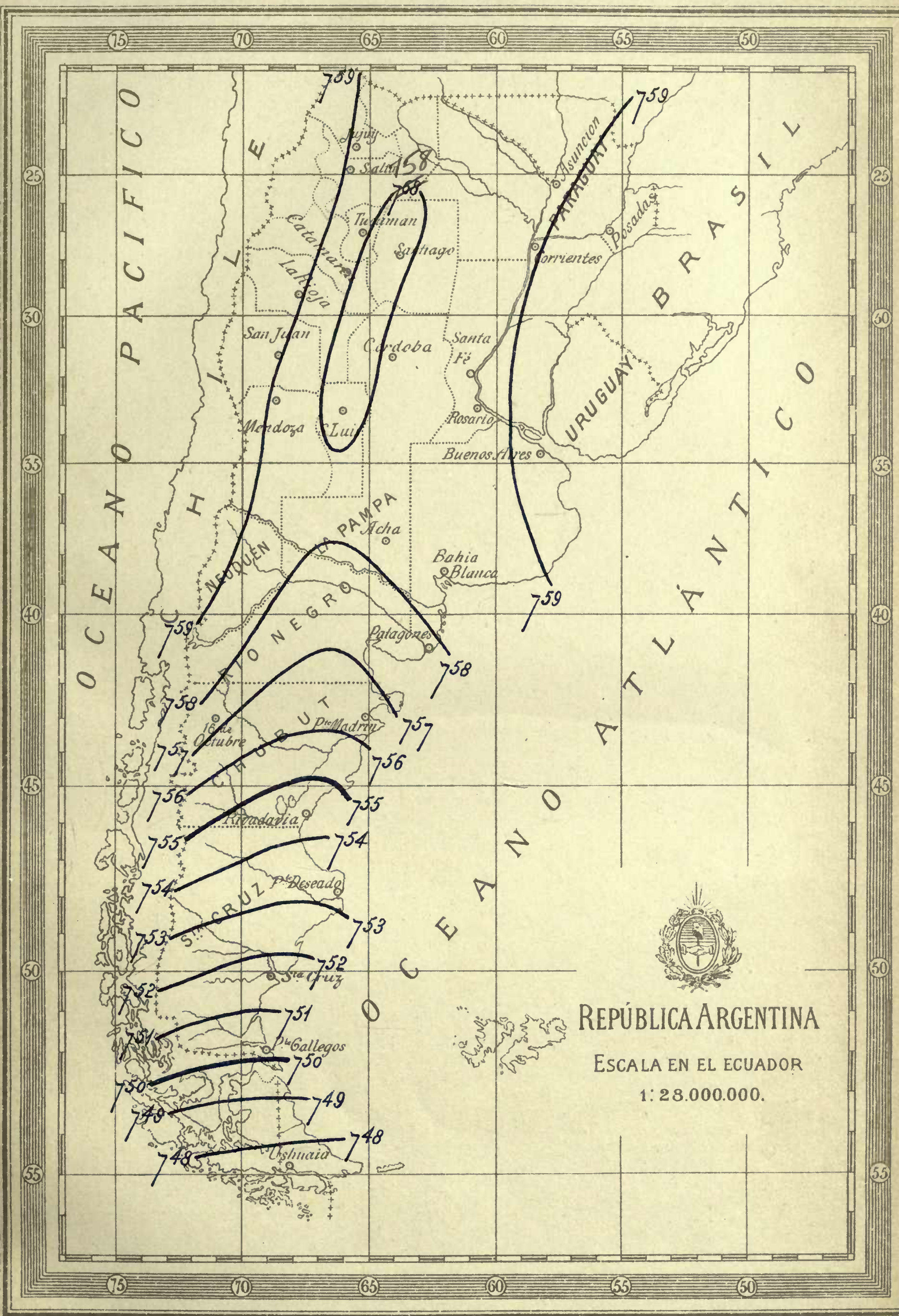
It is worthy of note that nearly all the ships which enter Argentine ports navigate by charts whose magnetic data are seriously inaccurate. The variation of the compass shown on maps of the River Plate and the coast of Buenos Aires have an error of about a degree and along certain sections of the southern coast even greater errors exist. In fog or on cloudy nights the mariner has to trust completely to those maps, and if he is unfamiliar with the coast it may happen that he thinks himself 100 kms. out to sea when in reality his ship is in danger of running aground.

MAGNETIC DECLINATION.

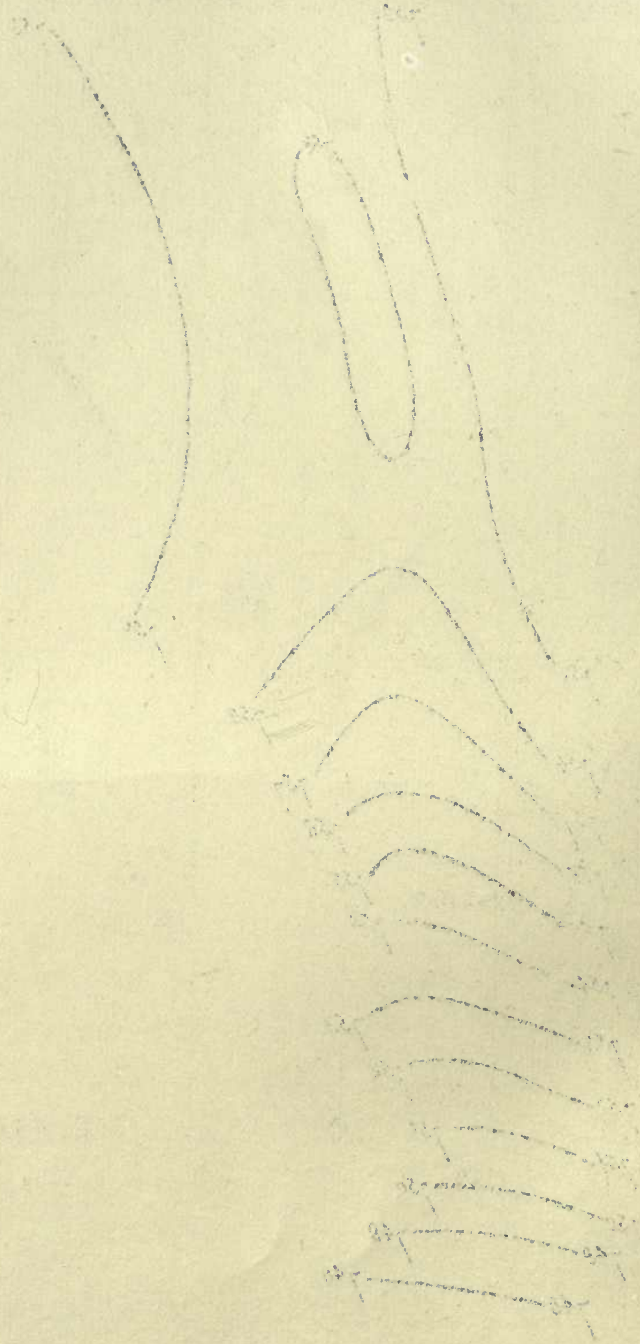
JANUARY 1st. 1908.

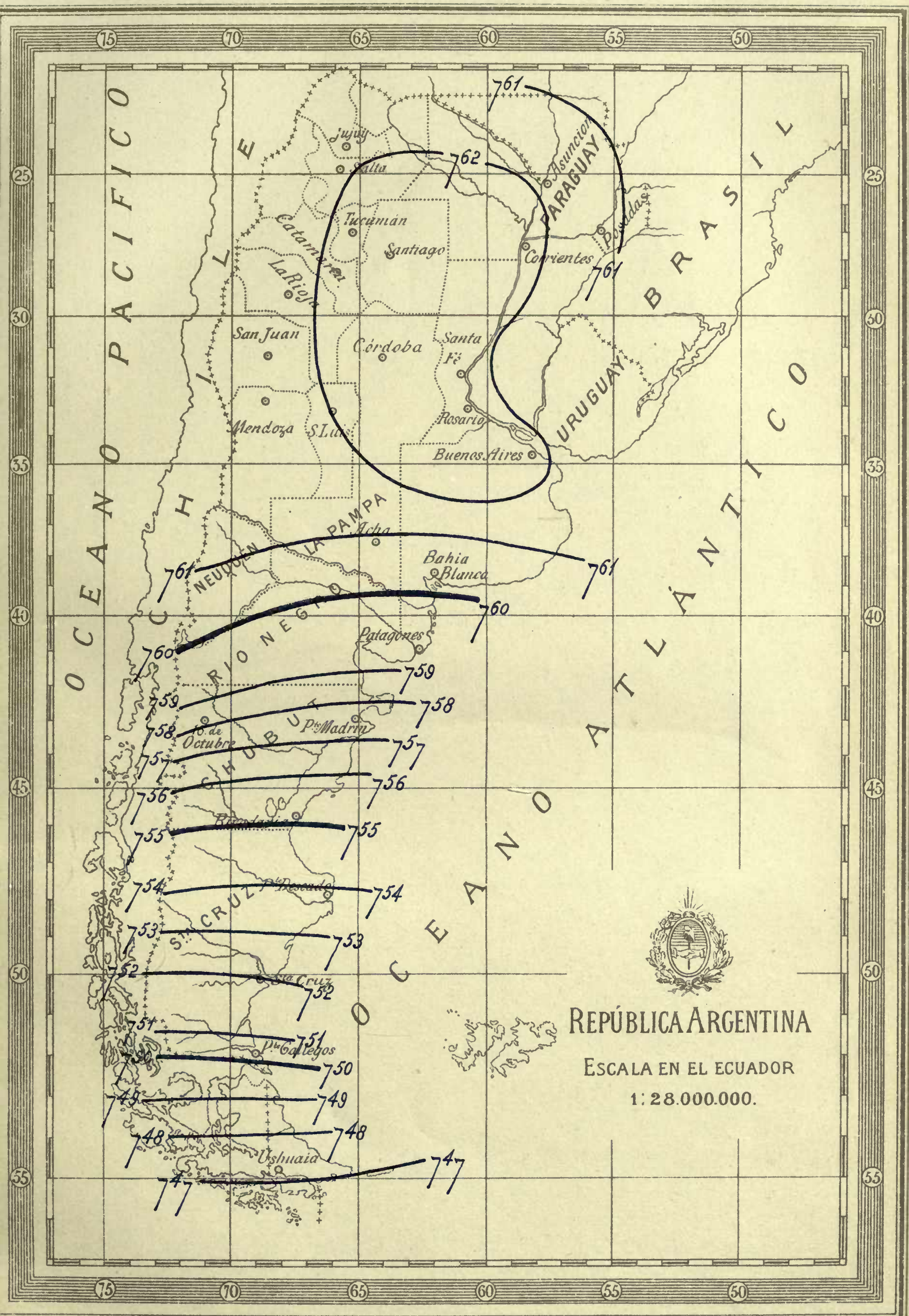
| STATION | Approximate Latitude | Approximate Longitude | Variation Jan. 1908 | Annual Change | STATION | Approximate Latitude | Approximate Longitude | Variation Jan. 1908 | Annual Change |
|---|---|---|---|---|---|---|---|---|---|
| Fed. Capital... | 34°24'S | 58°32' | 6°30'E | —7.5 | Rio Cuarto... | 33° 7'S | 64°19' | 10° 8'E | — |
| Alvear........... | 29 2 | 56 26 | 3 12 | — | Rosario........ | 32 58 | 60 35 | 7 30 | —7.5 |
| Bahia Blanca.. | 38 43 | 62 17 | 10 12 | —7.5 | Rufino......... | 34 13 | 62 43 | 9 27 | —7.5 |
| B. Concepcion | 28 6 | 55 27 | 2 12 | — | San Juan...... | 31 30 | 68 40 | 12 10 | —7.0 |
| Bragado........ | 35 3 | 60 27 | 8 20 | —7.5 | San Luis...... | 33 18 | 66 20 | 11 22 | — |
| Cabo Blanco.. | 47 12 | 65 43 | 14 22 | — | San Rafael.... | 34 35 | 68 30 | 13 15 | — |
| Choele Choel.. | 39 10 | 65 51 | 12 54 | — | Santa Cruz... | 50 7 | 70 44 | 16 43 | — |
| C. Rivadavia.. | 45 50 | 67 30 | 15 10 | — | Santa Fe...... | 31 40 | 60 42 | 7 20 | — |
| Concordia...... | 31 24 | 58 2 | 5 22 | — | Santo Tomé.. | 28 33 | 55 38 | 2 48 | — |
| Cordoba........ | 31 25 | 64 12 | 9 33 | —6.9 | Tandil.......... | 37 16 | 59 8 | 7 44 | —7.8 |
| Corrientes...... | 27 29 | 58 52 | 4 40 | — | T. Lauquen.. | 35 58 | 62 44 | 9 52 | —7.5 |
| General Acha. | 37 23 | 64 36 | 11 29 | —8.0 | Tres Arroyos. | 38 23 | 60 13 | 7 40 | —7.6 |
| Jujuy............ | 24 11 | 65 17 | 8 11 | —9.2 | Tucuman..... | 26 51 | 65 12 | 9 0 | — |
| La Paz.......... | 33 25 | 67 35 | 12 10 | — | Ushuaia........ | 54 52 | 68 7 | 17 41 | — |
| La Plata........ | 34 54 | 57 54 | 6 00 | —7.5 | Villa Dolores. | 31 57 | 65 14 | 10 22 | — |
| La Rioja....... | 29 18 | 67 2 | 11 5 | — | Villa Maria... | 32 35 | 63 14 | 9 20 | — |
| Mackenna...... | 33 53 | 64 23 | 10 22 | — | V. Mercedes.. | 33 42 | 65 28 | 11 5 | — |
| Mendoza....... | 32 53 | 68 49 | 12 48 | —7.0 | Villaguay...... | 31 50 | 59 1 | 5 52 | — |
| Mercedes....... | 34 40 | 59 26 | 7 22 | — | | | | | |
| Monte Caseros | 30 14 | 57 38 | 4 31 | — | | | | | |
| Neuquen....... | 38 58 | 68 0 | 13 55 | —7.5 | Montevideo... | 34 48 | 56 15 | 4 40 | —7.5 |
| SouthOrkneys | 60 44 | 44 39 | 5 9 | —6.9 | Sandy Point.. | 53 10 | 70 54 | 18 35 | — |
| Parana.......... | 30 44 | 60 31 | 7 12 | — | Santiago....... | 33 27 | 70 42 | 13 44 | — |
| Pilar............. | 31 40 | 63 52 | 9 33 | —6.9 | Valparaiso.... | 33 2 | 71 41 | 13 47 | — |
| Pto. Deseado.. | 47 45 | 65 55 | 14 57 | — | Asuncion...... | 25 17 | 57 40 | 3 10 | — |
| R. Gallegos... | 51 53 | 68 59 | 17 27 | — | Corumba...... | 19 0 | 57 39 | 1 50 | — |
| P. Madryn..... | 42 48 | 64 58 | 12 47 | — | Cuyabá......... | 15 36 | 56 6 | 0 0 | — |
| Pta. Piedras... | 35 27 | 57 6 | 5 27 | — | P. Alegre.... | 30 2 | 51 10 | 1 0W | — |
| Recreo.......... | 29 16 | 65 5 | 9 30 | —8.0 | Rio Grande.. | 32 2 | 52 8 | 0 10E | — |

The (—) sign indicates a decrease in the easterly deviation, i. e. the north end of the needle is varying toward the west.

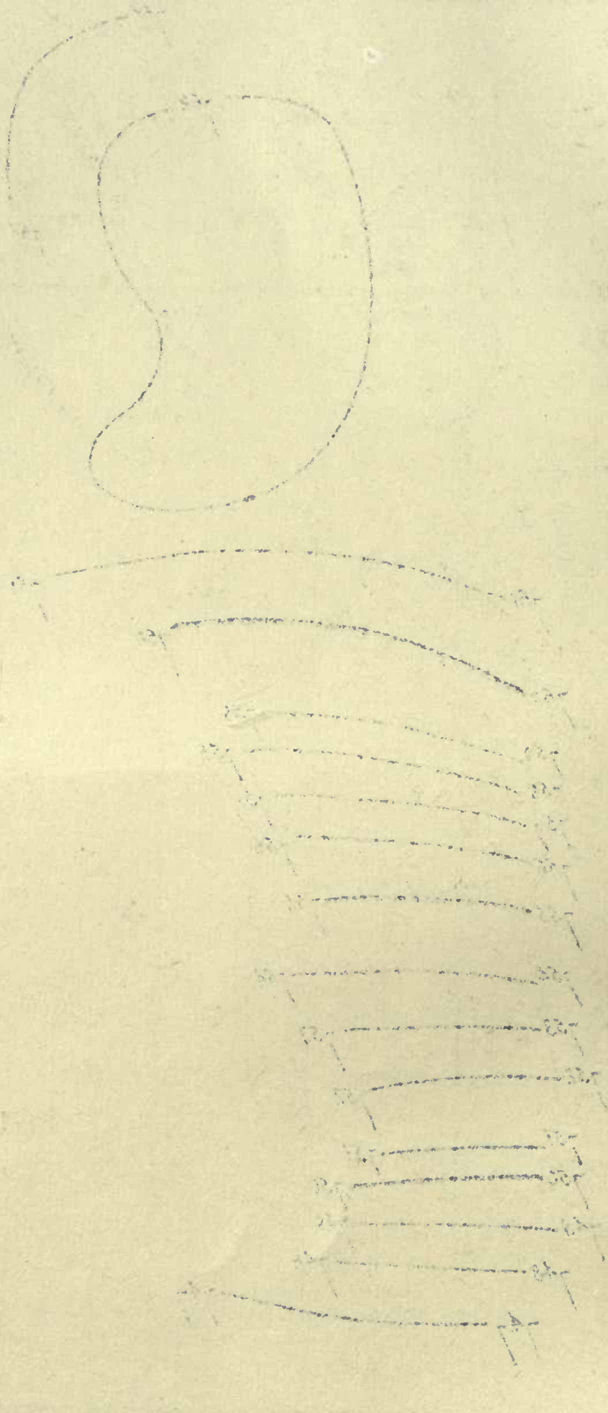



Talleres de Impresiones de la Oficina Meteorologica Argentina

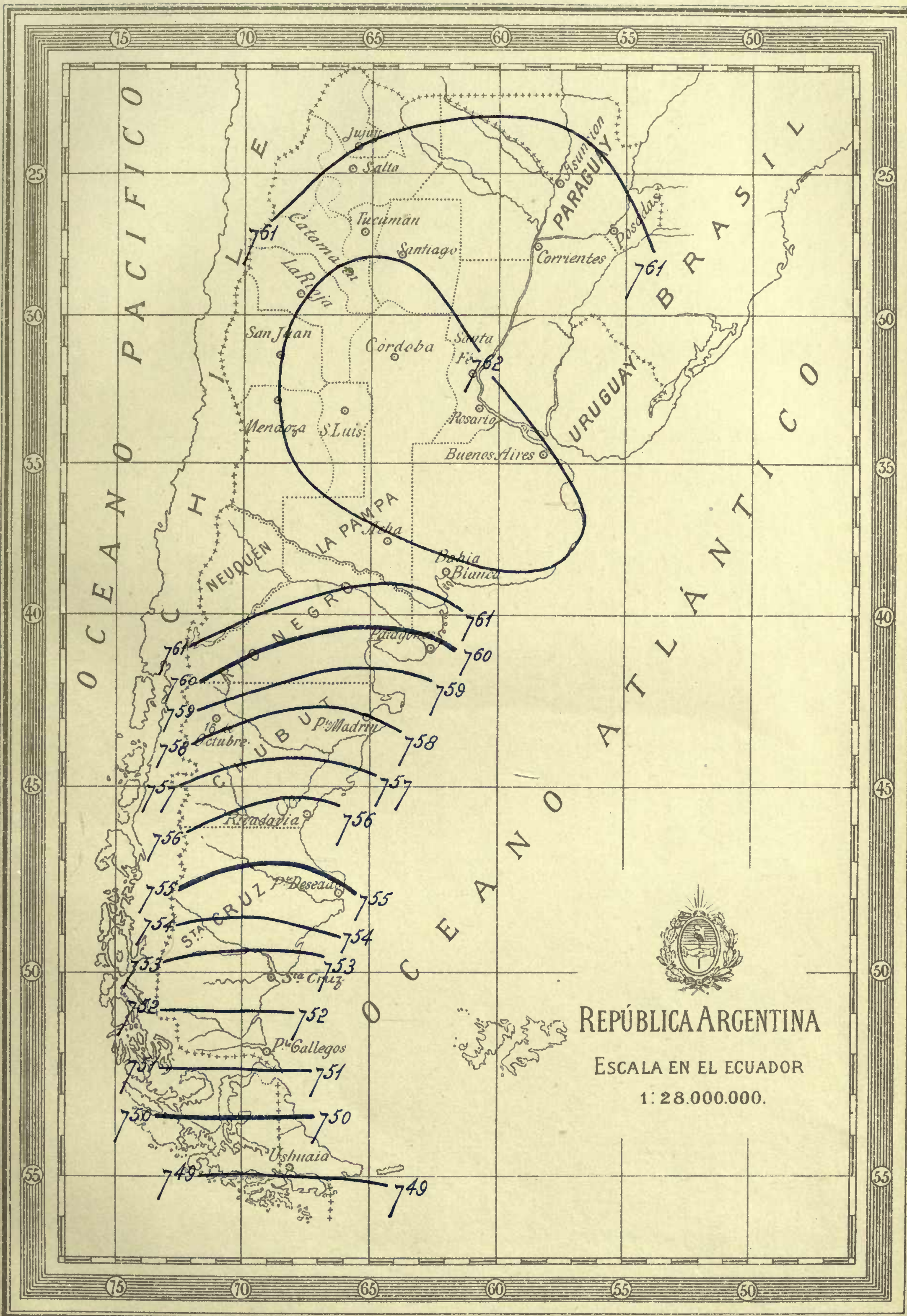




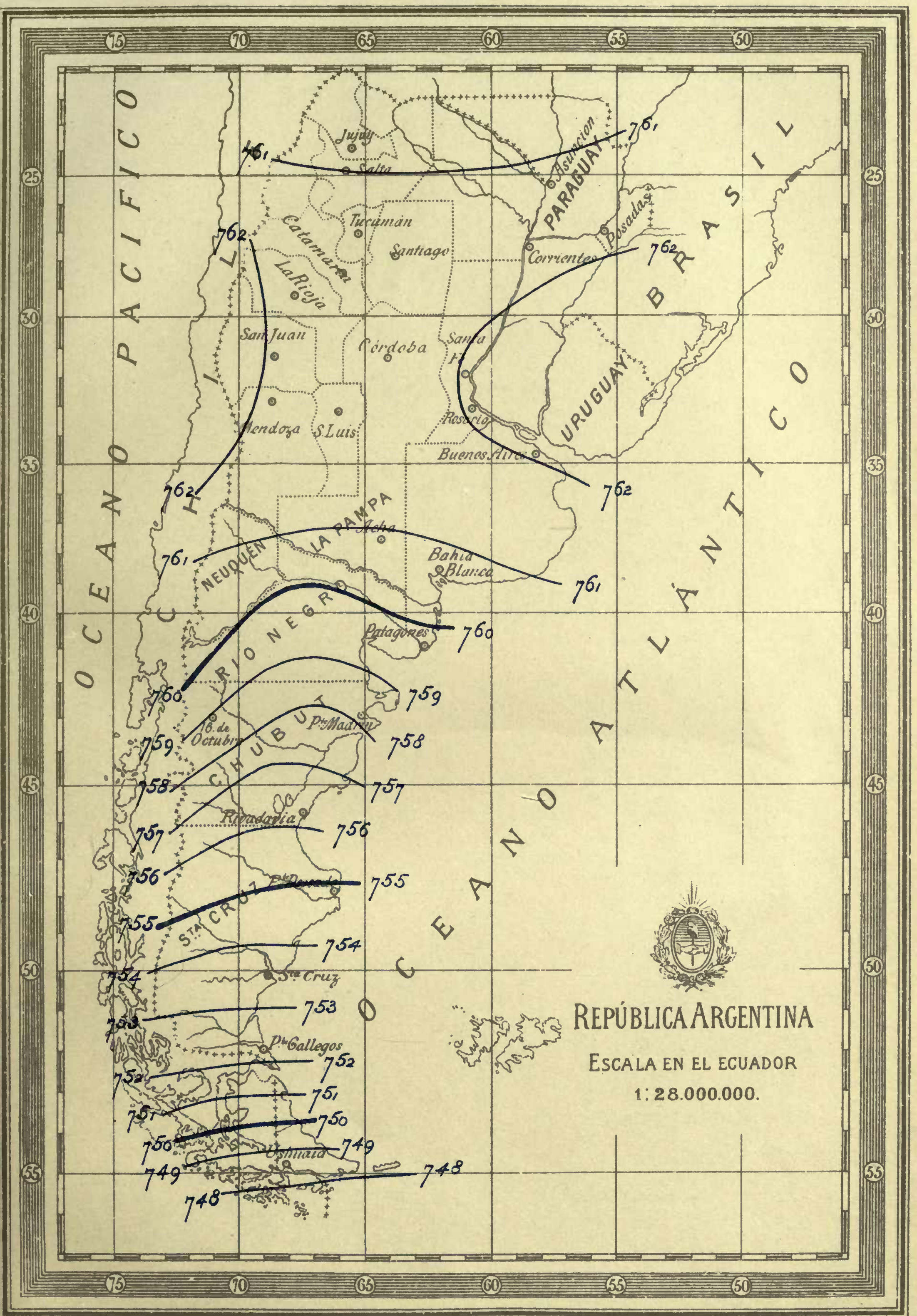

Talleres de Impresiones de la Oficina Meteorologica Argentina



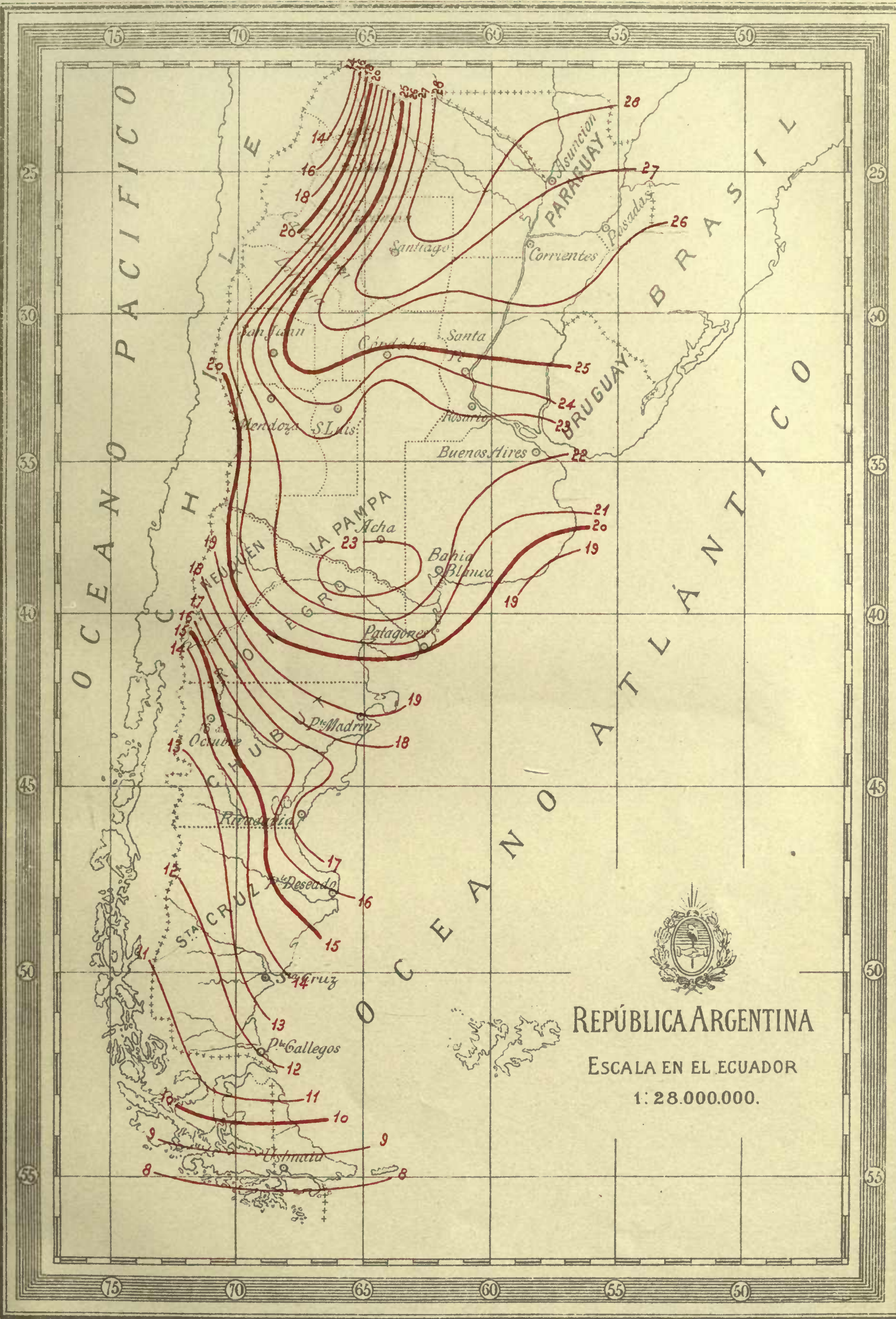

Talleres de Impresiones de la Oficina Meteorologica Argentina



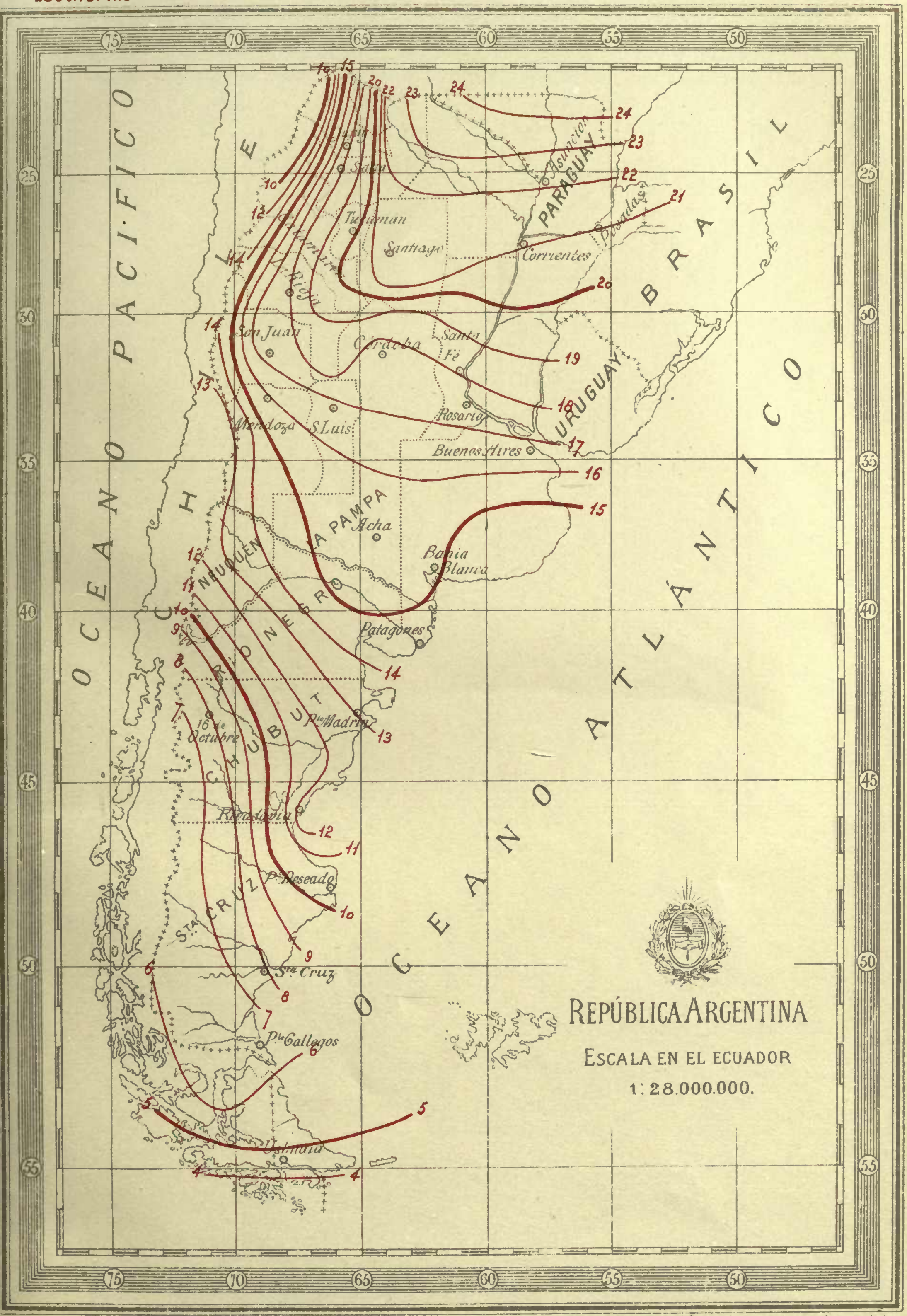

Talleres de Impresiones de la Oficina Meteorologica Argentina



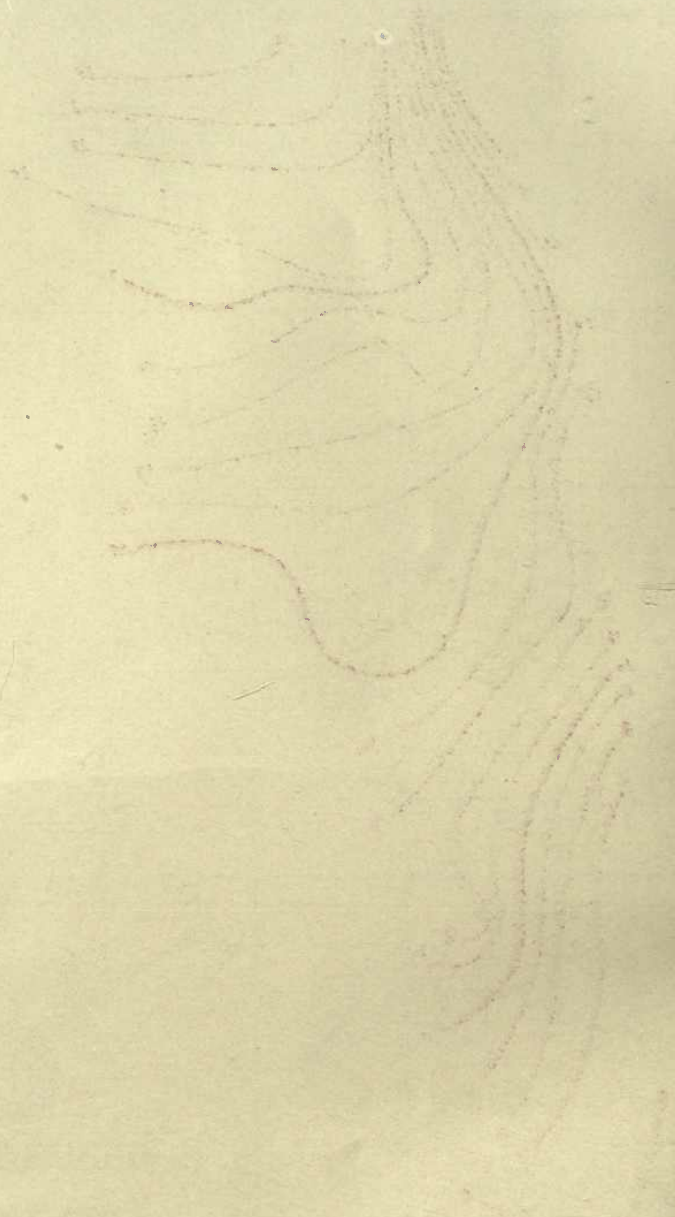

Talleres de Impresiones de la Oficina Meteorologica Argentina



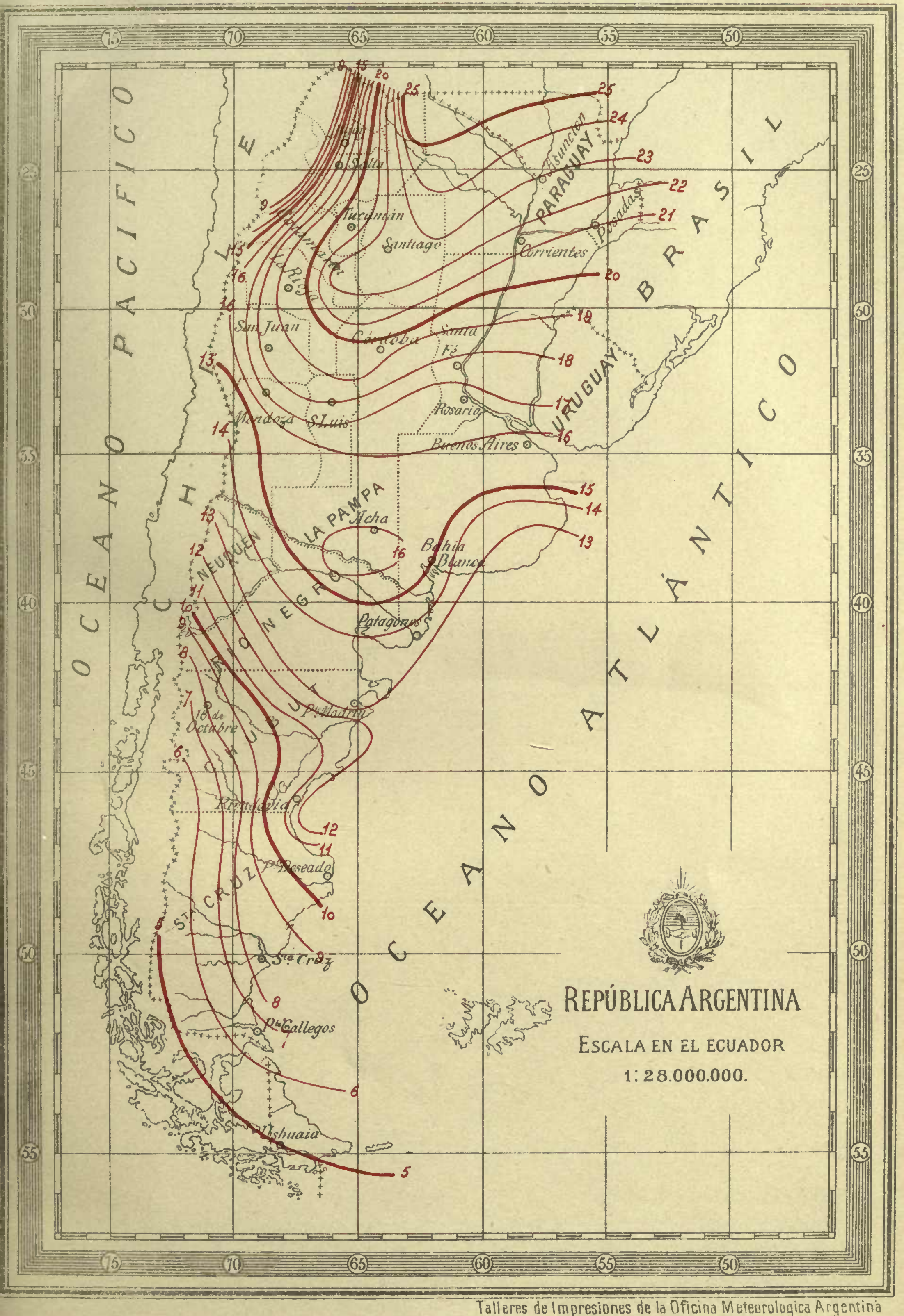

Talleres de Impresiones de la Oficina Meteorologica Argentina



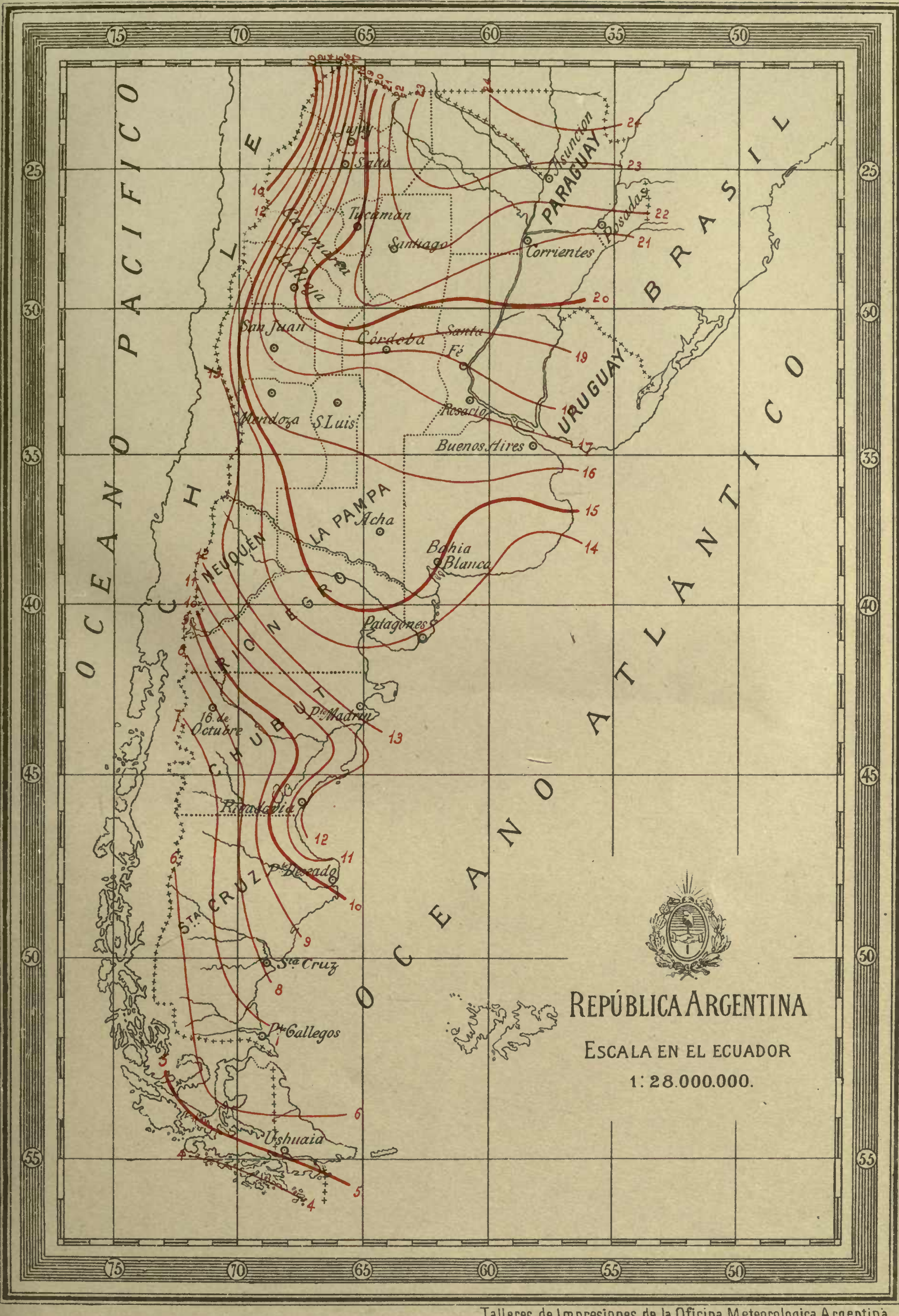

Talleres de Impresiones de la Oficina Meteorologica Argentina



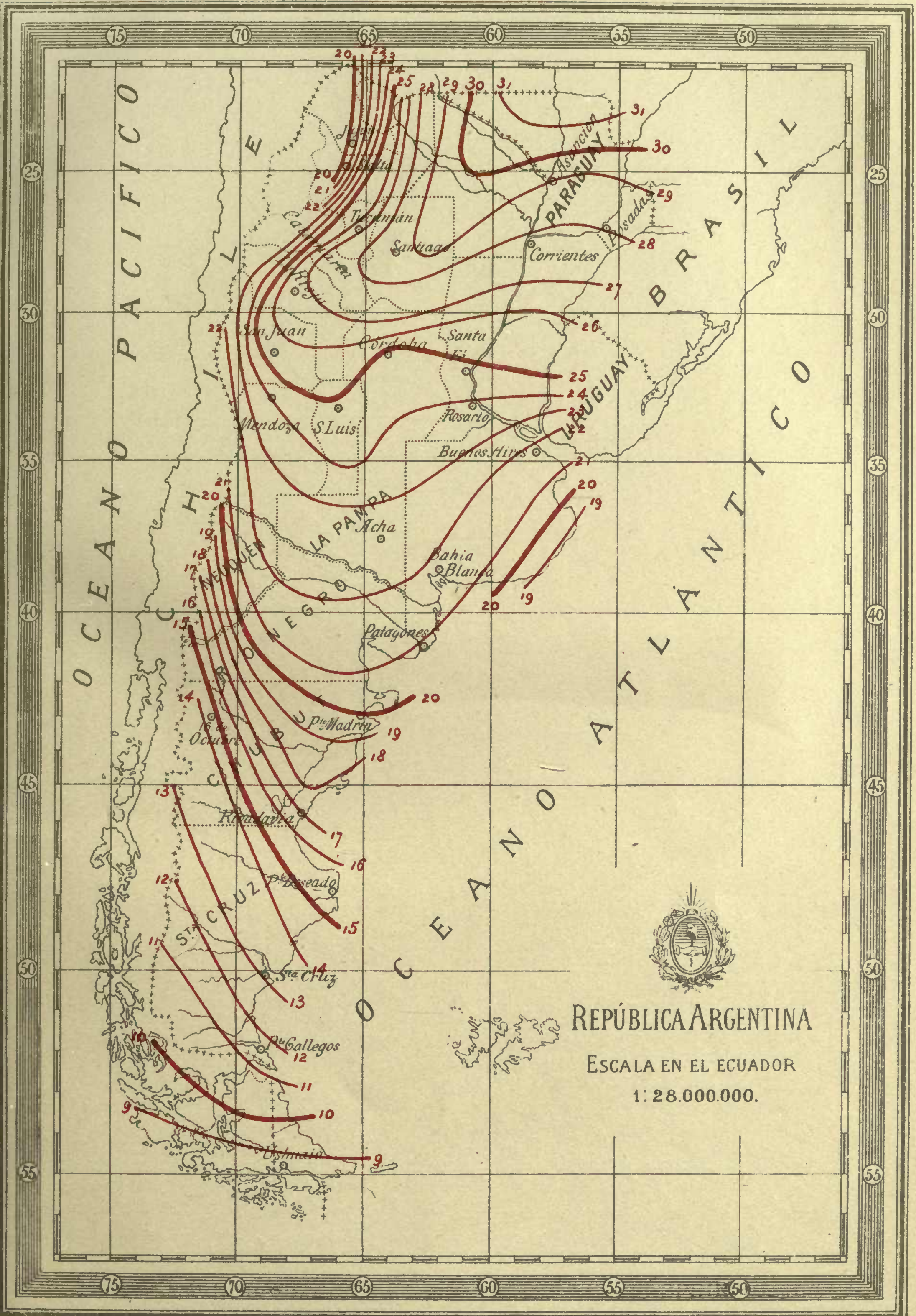

Talleres de Impresiones de la Oficina Meteorologica Argentina



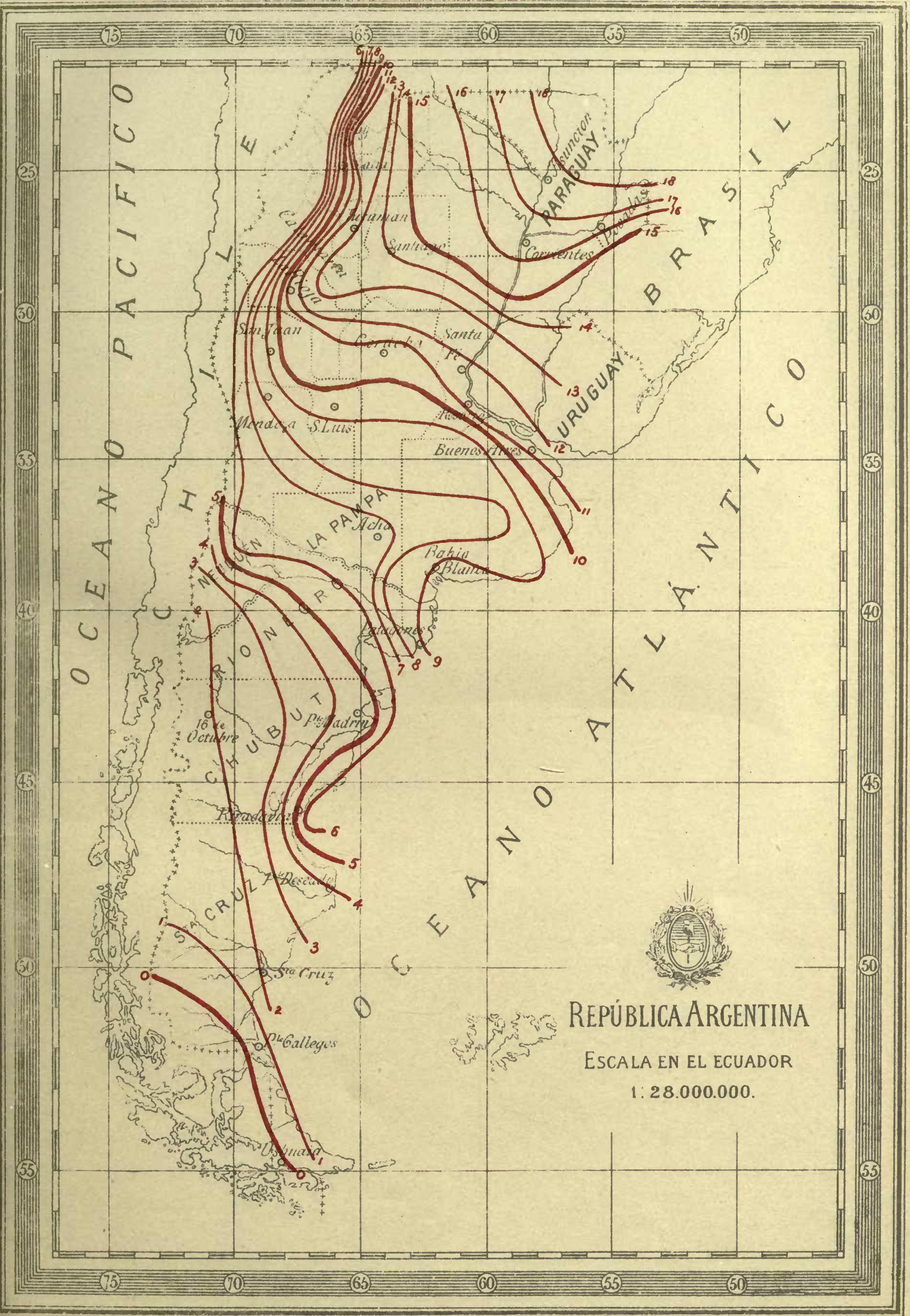

Talleres de Impresiones de la Oficina Meteorologica Argentina



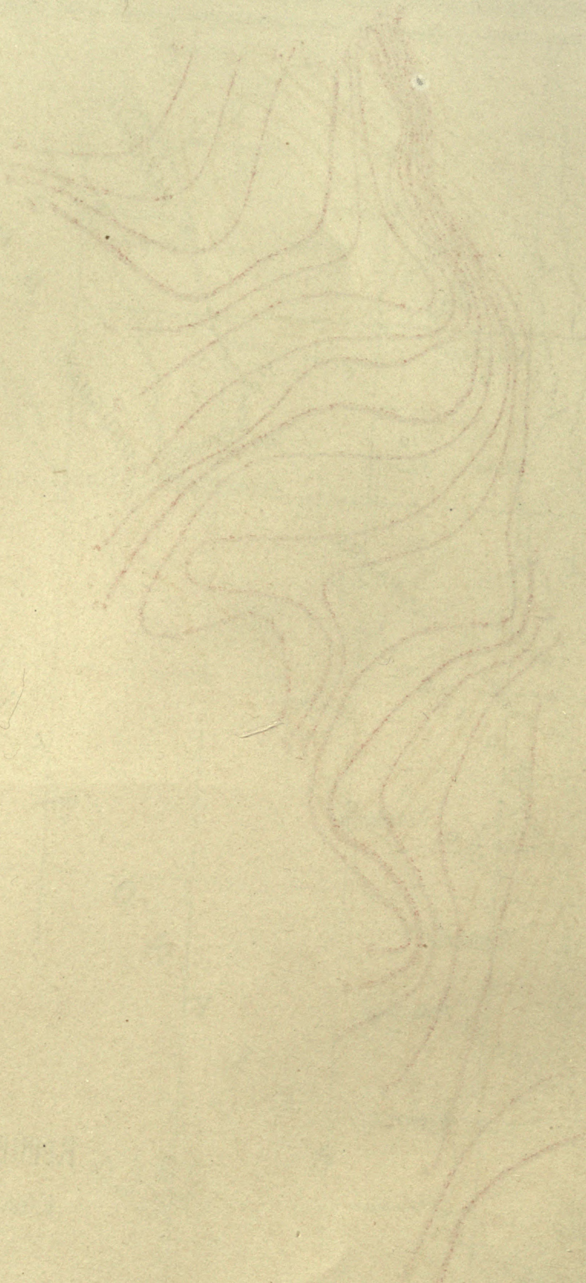

Talleres de Impresiones de la Oficina Meteorologica Argentina




Talleres de Impresiones de la Oficina Meteorologica Argentina

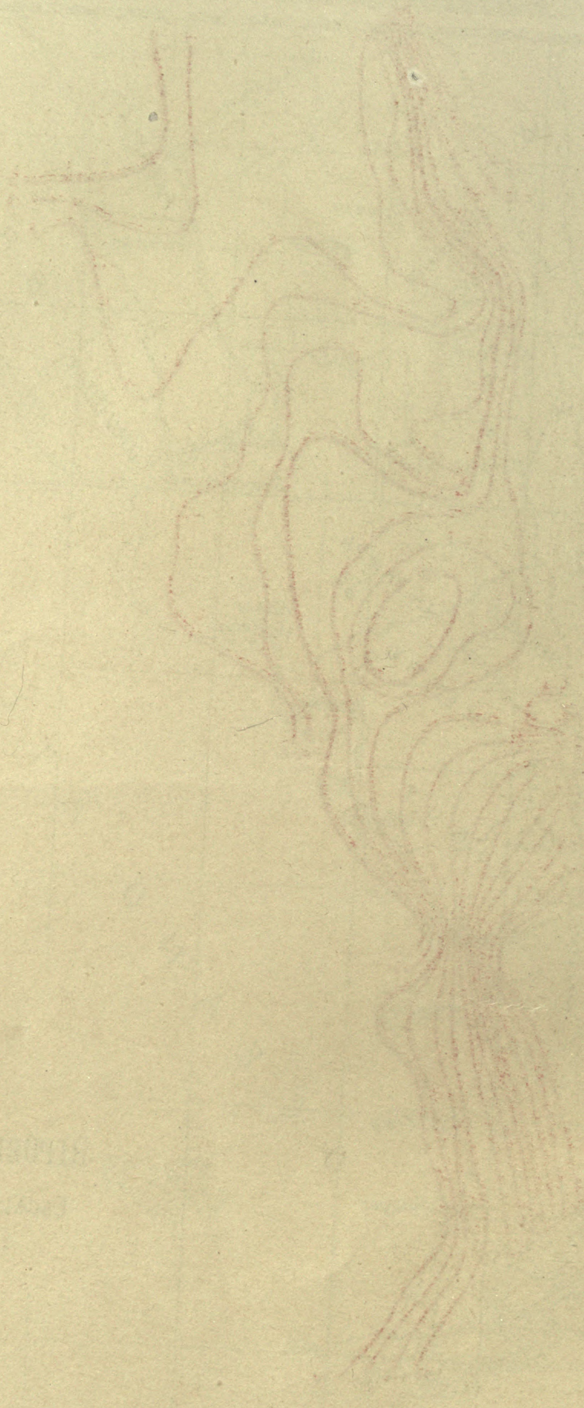



Talleres de Impresiones de la Oficina Meteorologica Argentina




Talleres de Impresiones de la Oficina Meteorologica Argentina


Talleres de Impresiones de la Oficina Meteorologica Argentina



WET SEASON
(OCTOBER TO MARCH)




Talleres de Impresiones de la Oficina Meteorologica Argentina

RAINFALL

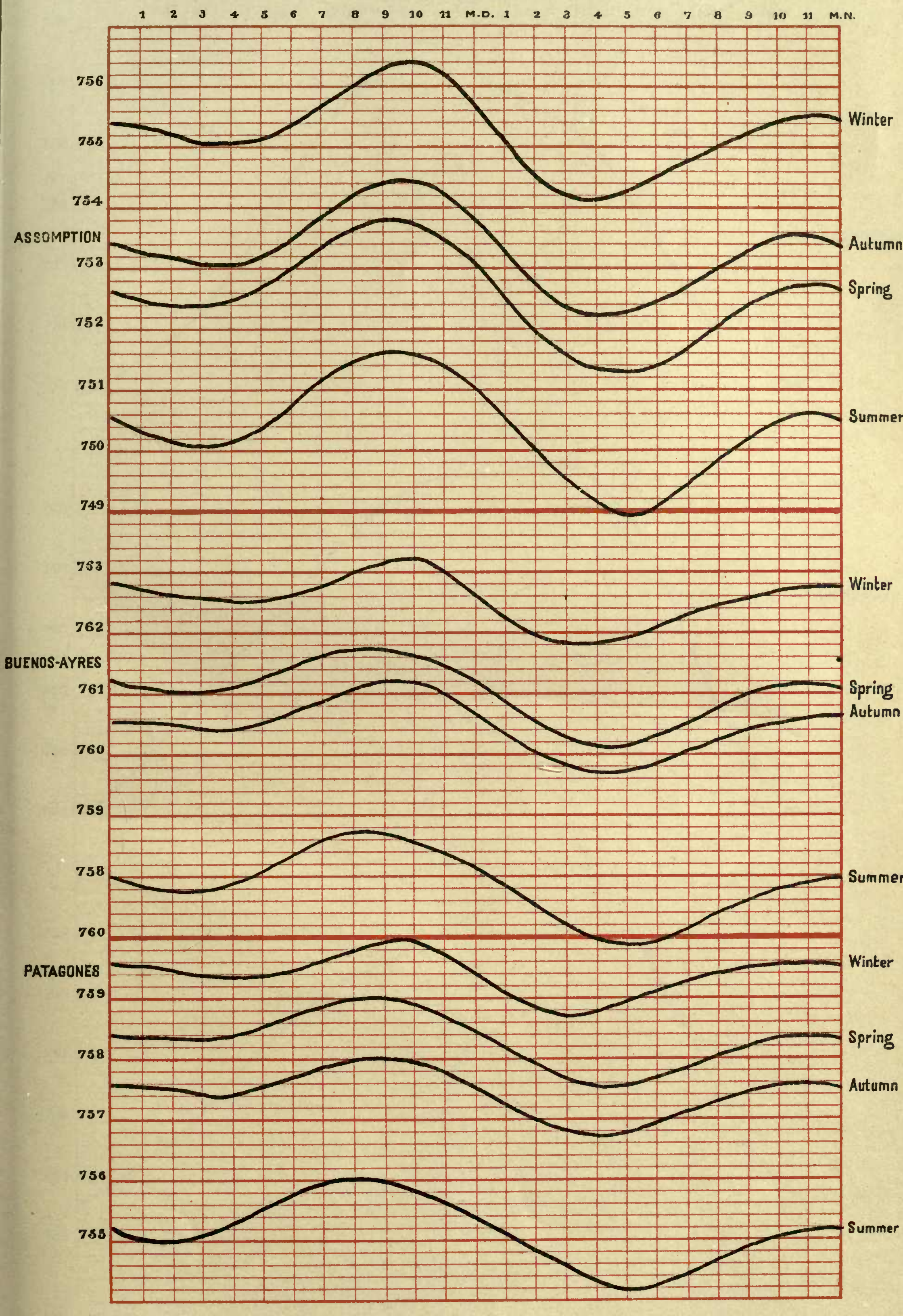
DRY SEASON
(APRIL to SEPTEMBER)

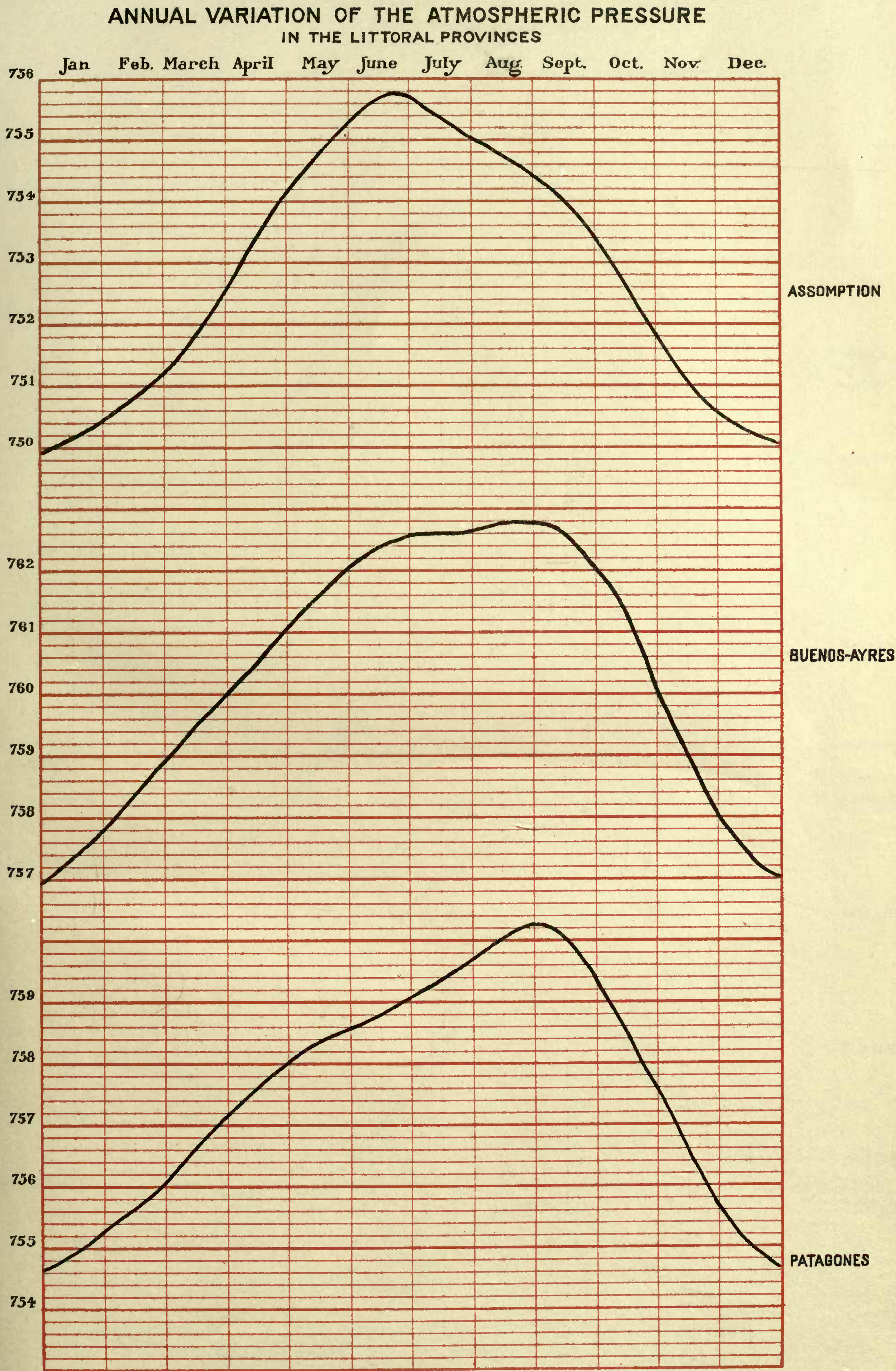
PLATE XVI

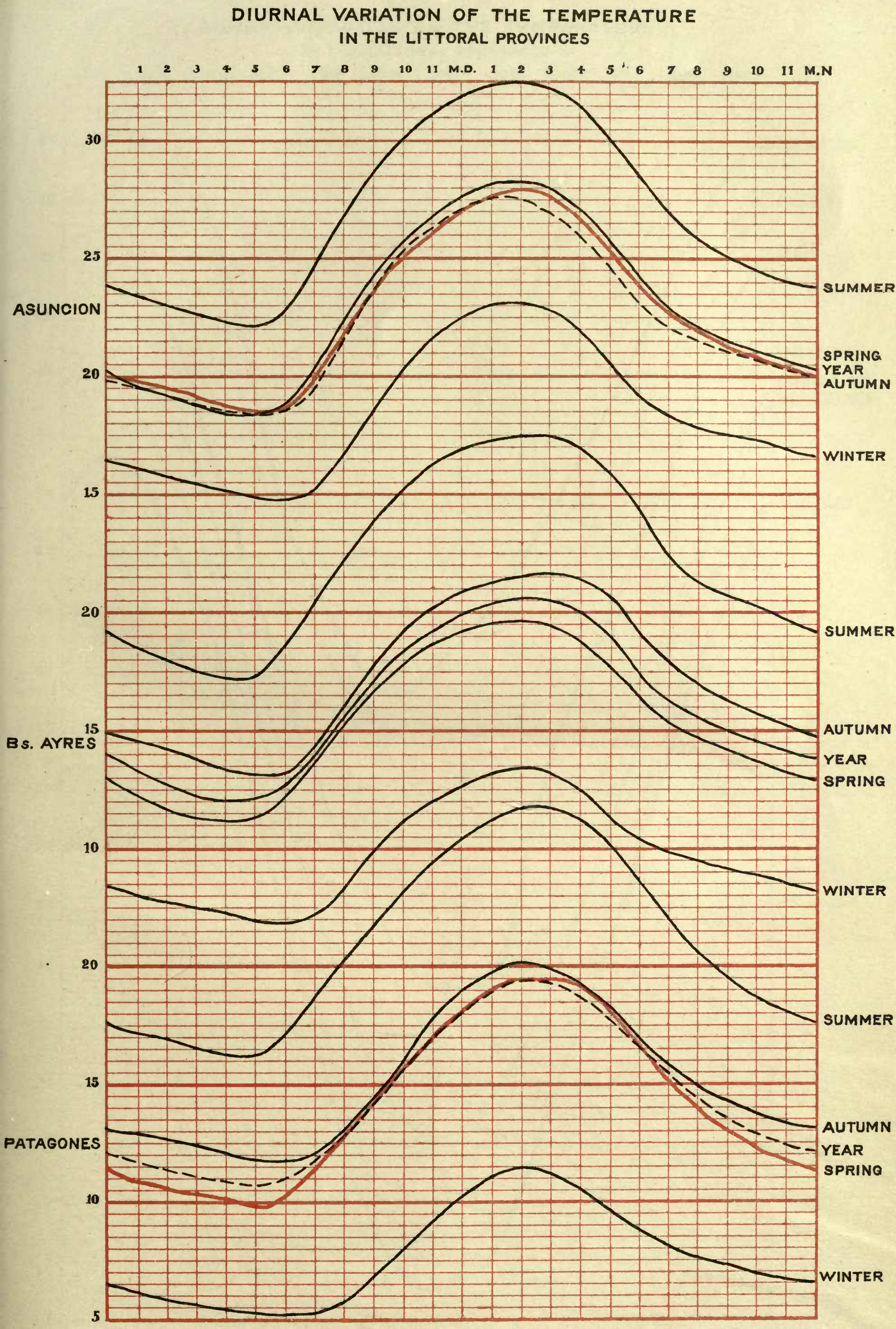

Talleres de Impresiones de la Oficina Meteorologica Argentina

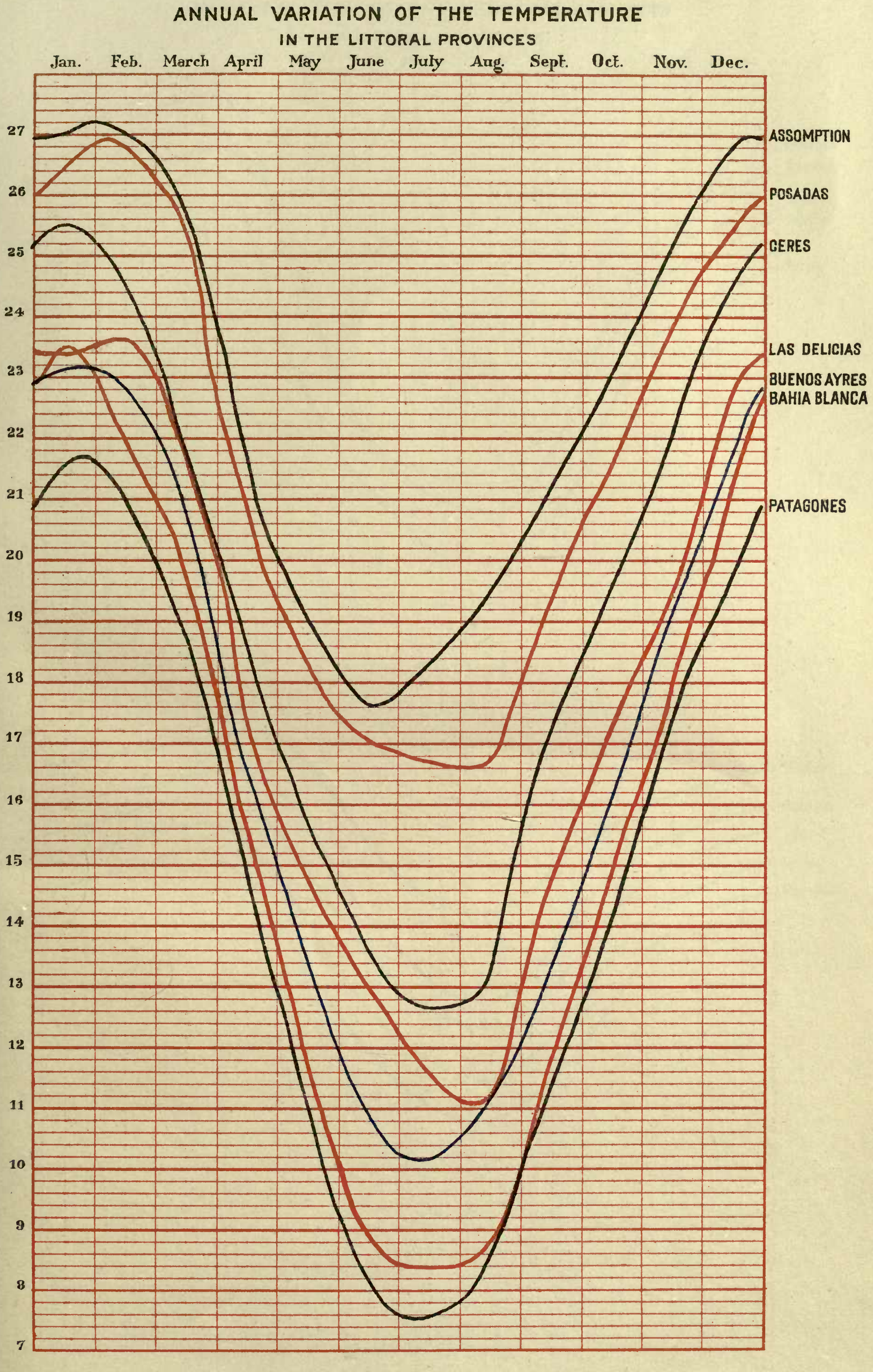

Talleres de Impresiones de la Oficina Meteorologica Argentina

## DIURNAL VARIATION OF THE ATMOSPHERIC PRESSURE
### IN THE LITTORAL PROVINCES



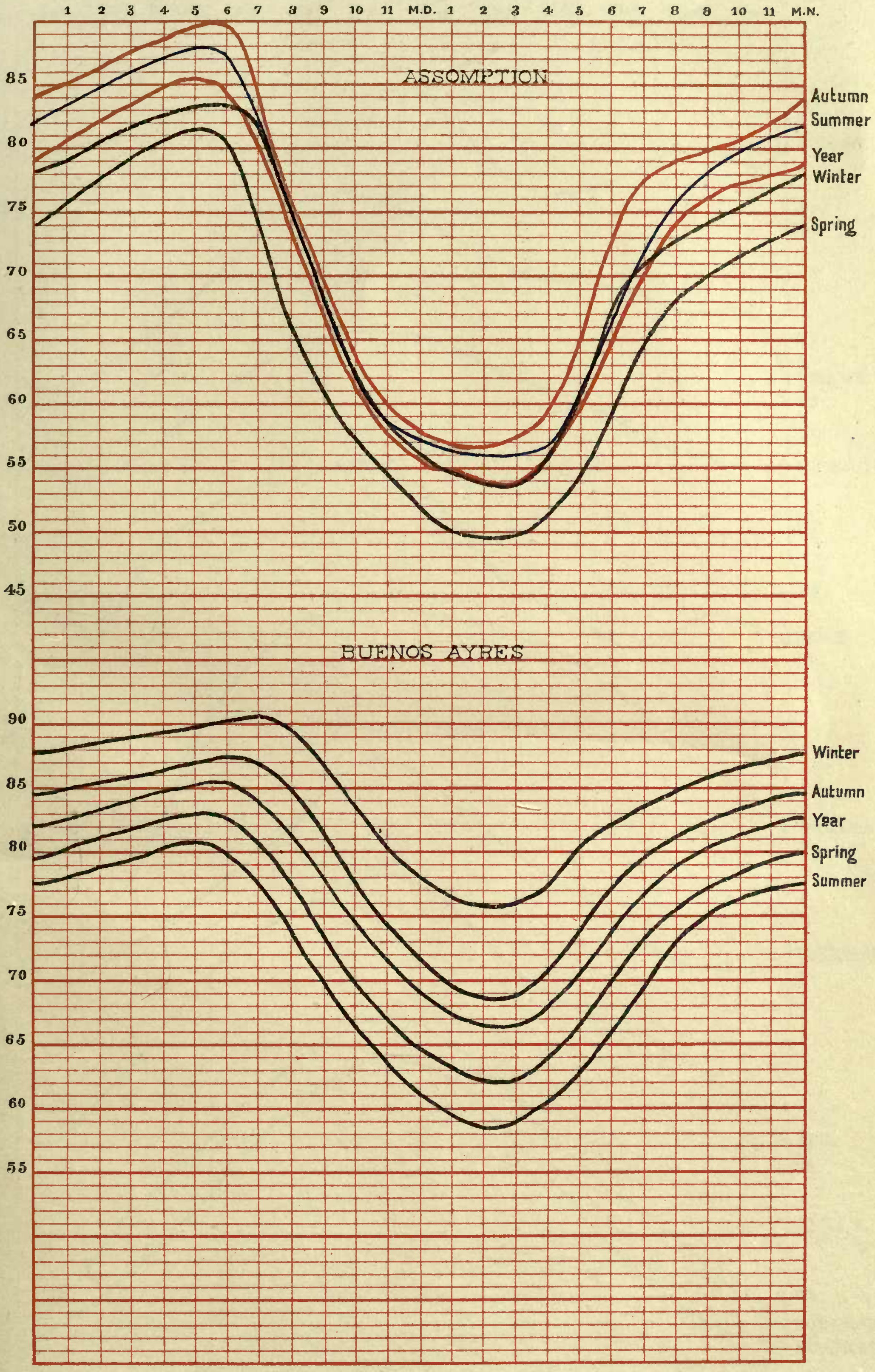

ANNUAL VARIATION OF THE ATMOSPHERIC PRESSURE
IN THE LITTORAL PROVINCES
Jan
Feb.
March
April
May
June
July
Aug.
Sept.
Oct.
Nov.
Dec.
756
755
754
753
752
751
750
ASSOMPTION
762
761
760
759
758
757
BUENOS-AYRES
759
758
757
756
755
754
PATAGONES

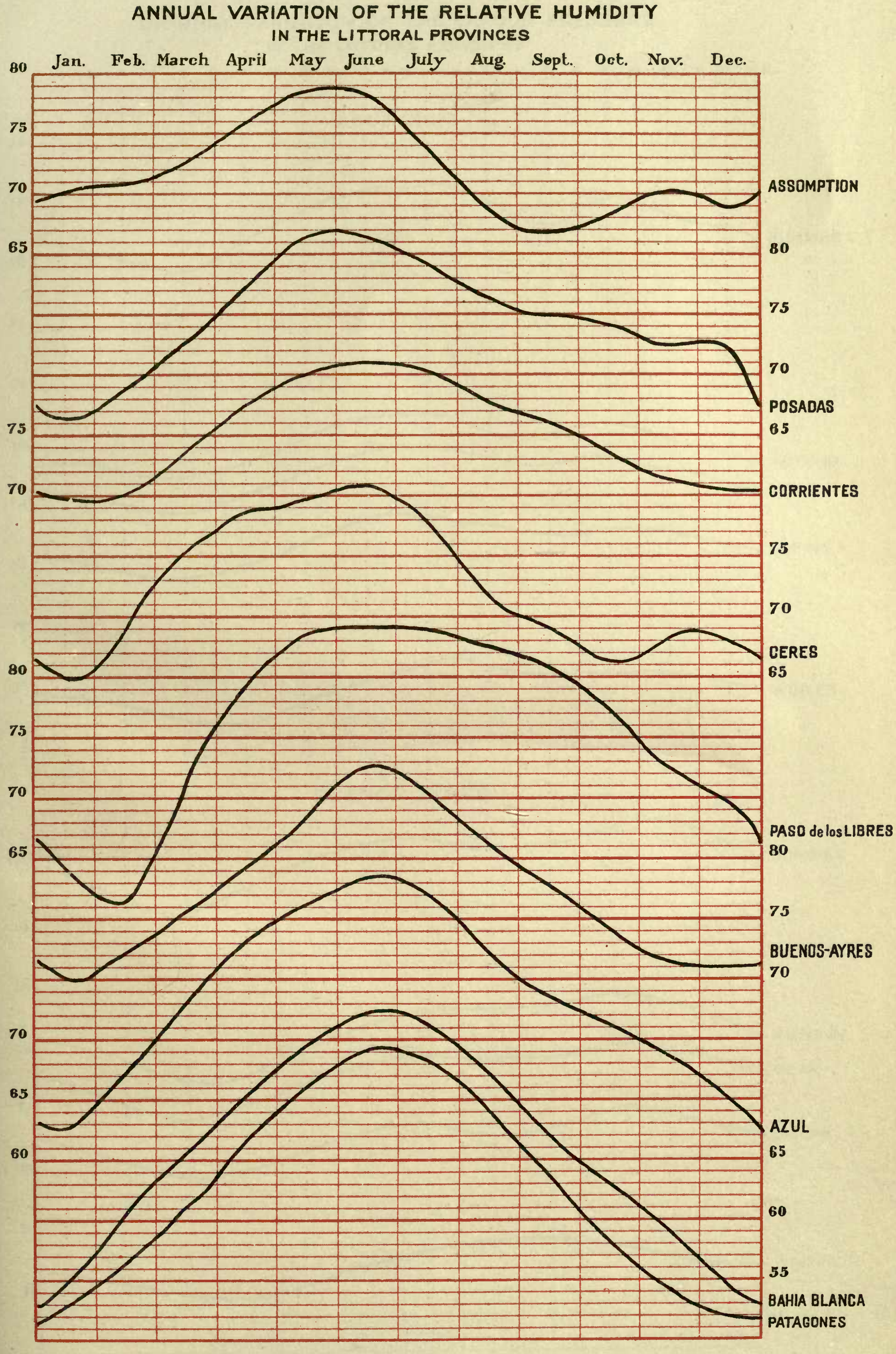

DIURNAL VARIATION OF THE TEMPERATURE
IN THE LITTORAL PROVINCES
1 2 3 4 5 6 7 8 9 10 11 M.D. 1 2 3 4 5 6 7 8 9 10 11 M.N
30
25
20
15
20
15
10
20
15
10
5
ASUNCION
Bs. AYRES
PATAGONES
SUMMER
SPRING
YEAR
AUTUMN
WINTER
SUMMER
AUTUMN
YEAR
SPRING
WINTER
SUMMER
AUTUMN
YEAR
SPRING
WINTER

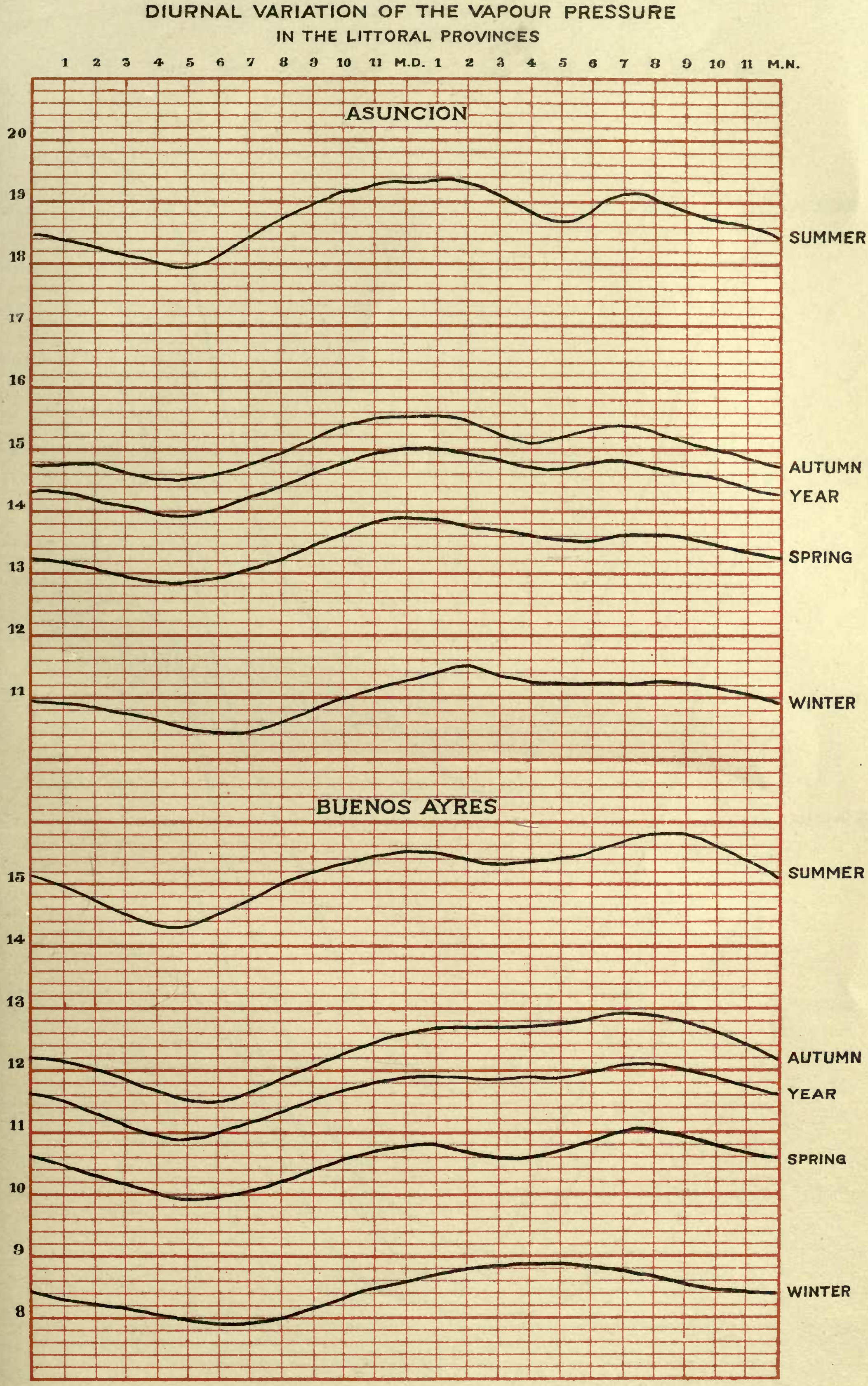

ANNUAL VARIATION OF THE TEMPERATURE
IN THE LITTORAL PROVINCES
Jan.
Feb.
March
April
May
June
July
Aug.
Sept.
Oct.
Nov.
Dec.
27
26
25
24
23
22
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
ASSOMPTION
POSADAS
CERES
LAS DELICIAS
BUENOS AYRES
BAHIA BLANCA
PATAGONES

DIURNAL VARIATION OF THE RELATIVE HUMIDITY

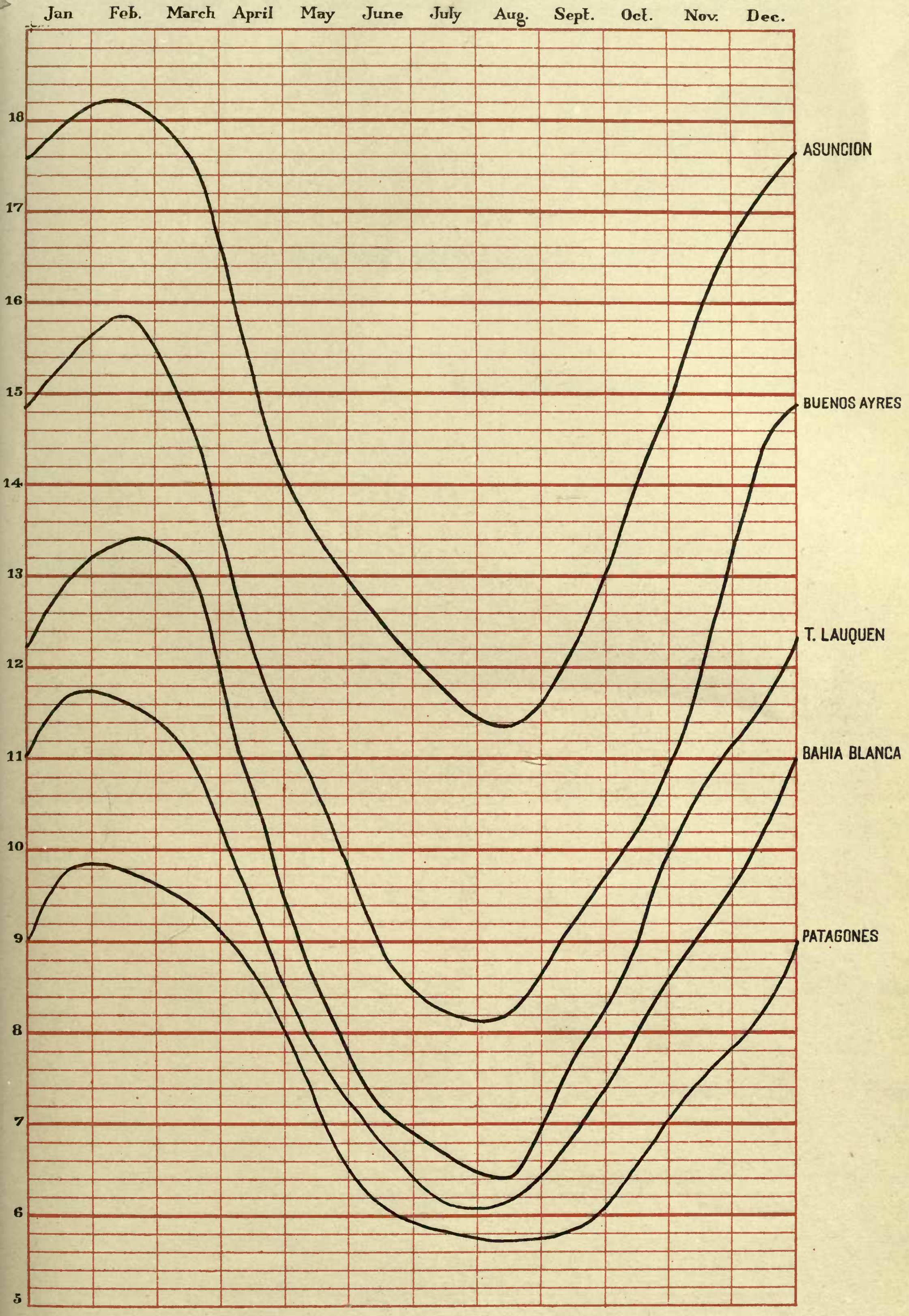
IN THE LITTORAL PROVINCES

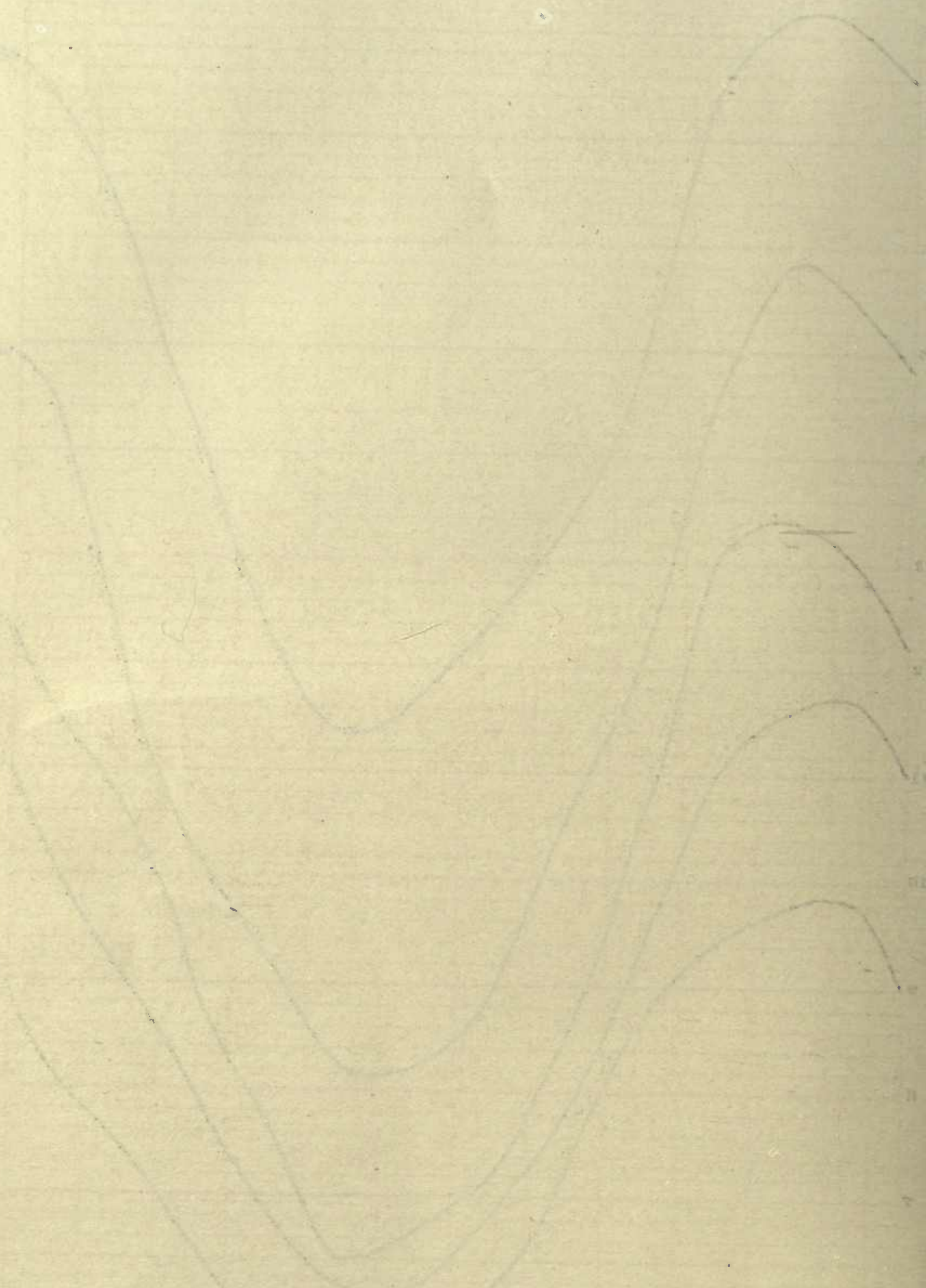



ANNUAL VARIATION OF THE RELATIVE HUMIDITY
IN THE LITTORAL PROVINCES
Jan.
Feb.
March
April
May
June
July
Aug.
Sept.
Oct.
Nov.
Dec.
80
75
70
65
75
70
80
75
70
65
70
65
60
ASSOMPTION
80
75
70
POSADAS
65
CORRIENTES
75
70
CERES
65
PASO de los LIBRES
80
75
BUENOS-AYRES
70
AZUL
65
60
55
BAHIA BLANCA
PATAGONES

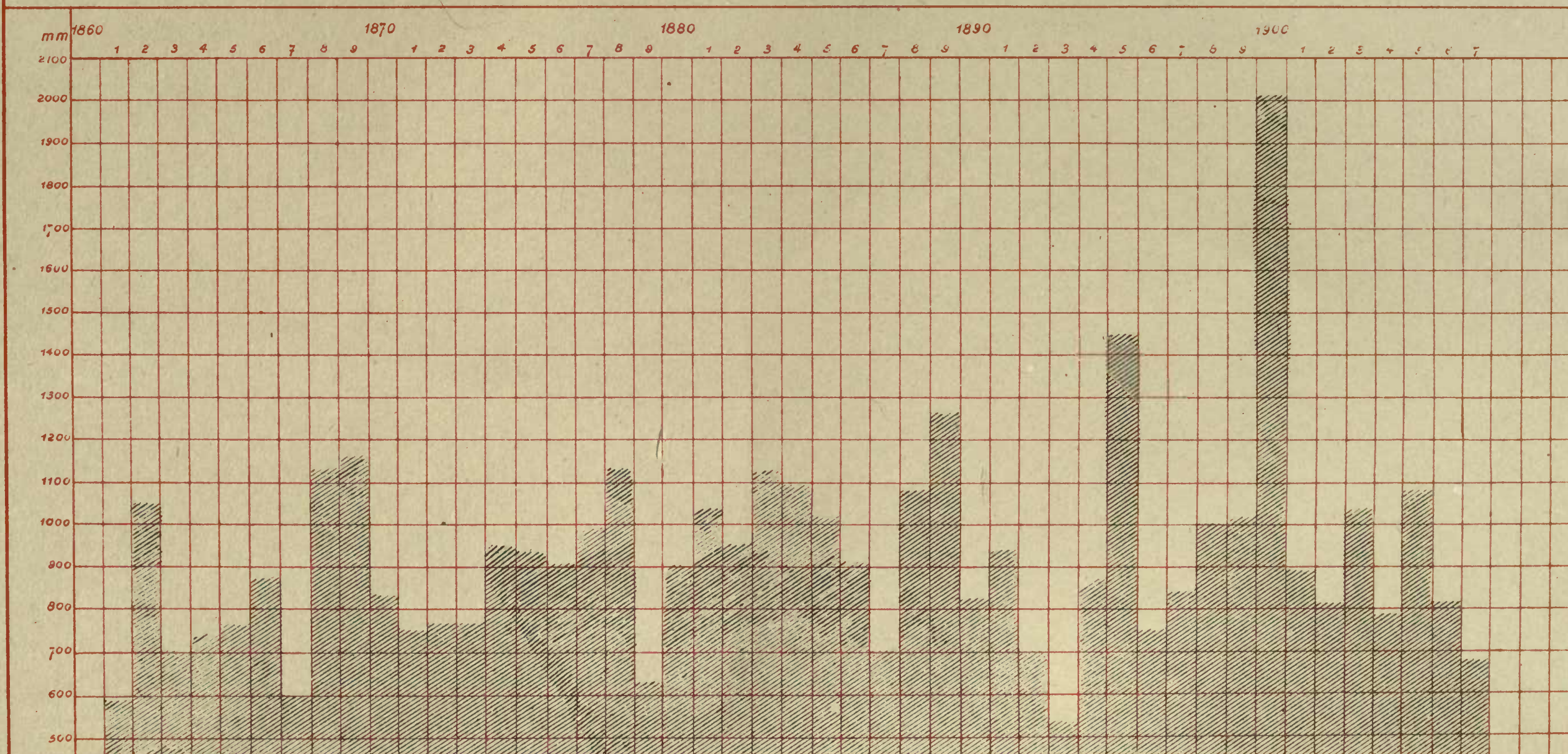

DIURNAL VARIATION OF THE VAPOUR PRESSURE
IN THE LITTORAL PROVINCES
1 2 3 4 5 6 7 8 9 10 11 M.D. 1 2 3 4 5 6 7 8 9 10 11 M.N.
ASUNCION
20
19
18
17
16
15
14
13
12
11
SUMMER
AUTUMN
YEAR
SPRING
WINTER
BUENOS AYRES
15
14
13
12
11
10
9
8
SUMMER
AUTUMN
YEAR
SPRING
WINTER

ANNUAL VARIATION OF THE VAPOUR PRESSURE
IN THE LITTORAL PROVINCES

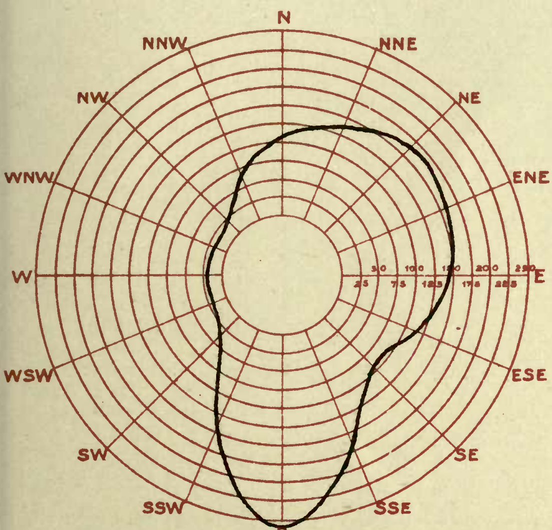




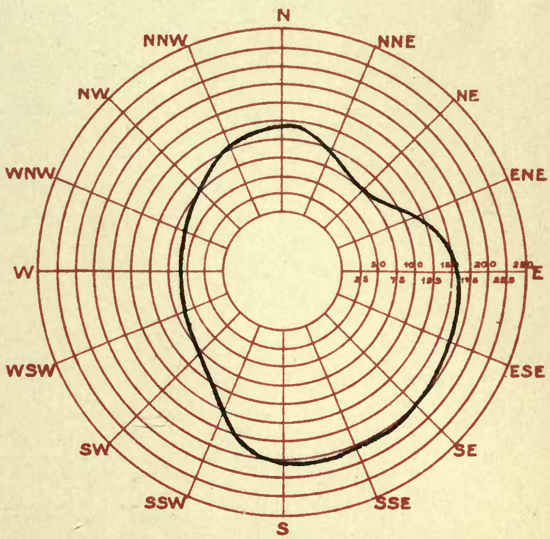
ANNUAL RAINFALL IN BUENOS AIRES



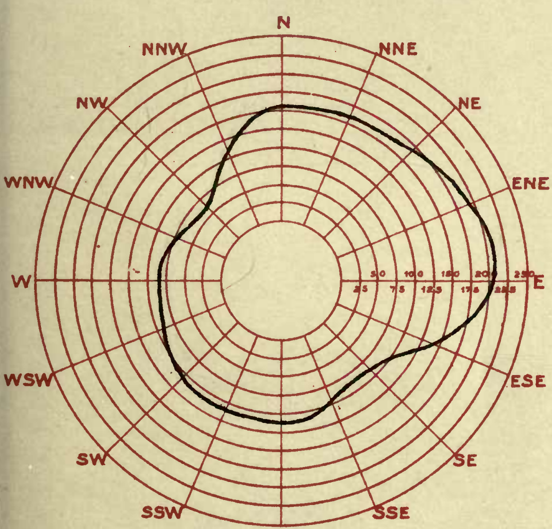
## RELATIVE FREQUENCY OF THE WINDS
### IN THE LITTORAL PROVINCES



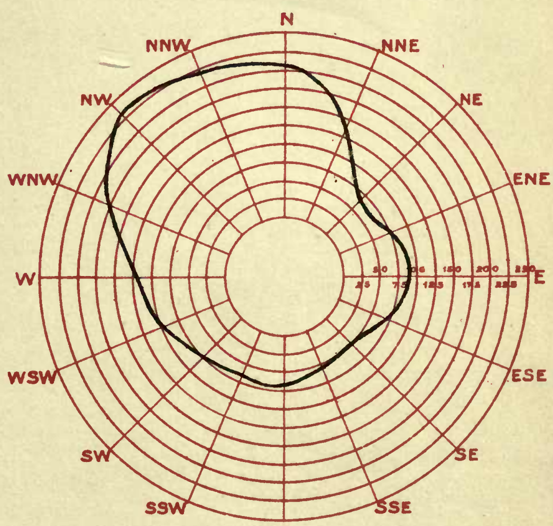

ASUNCION




ROSARIO




BUENOS AYRES




BAHIA BLANCA

Plate XXVIII

DIURNAL VARIATION OF THE TEMPERATURE
IN THE MEDITERRANEAN PROVINCES

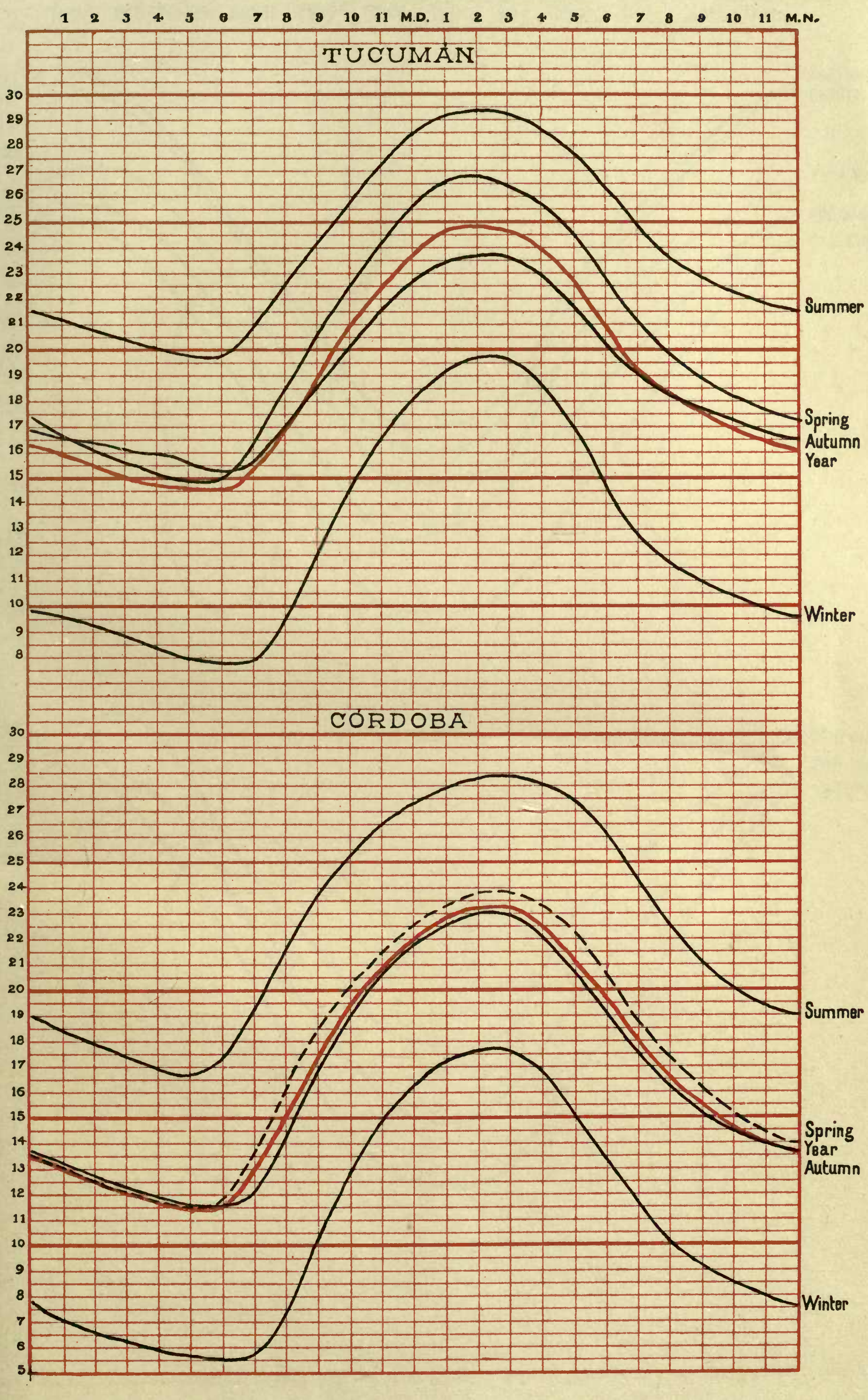


Plate XXIX

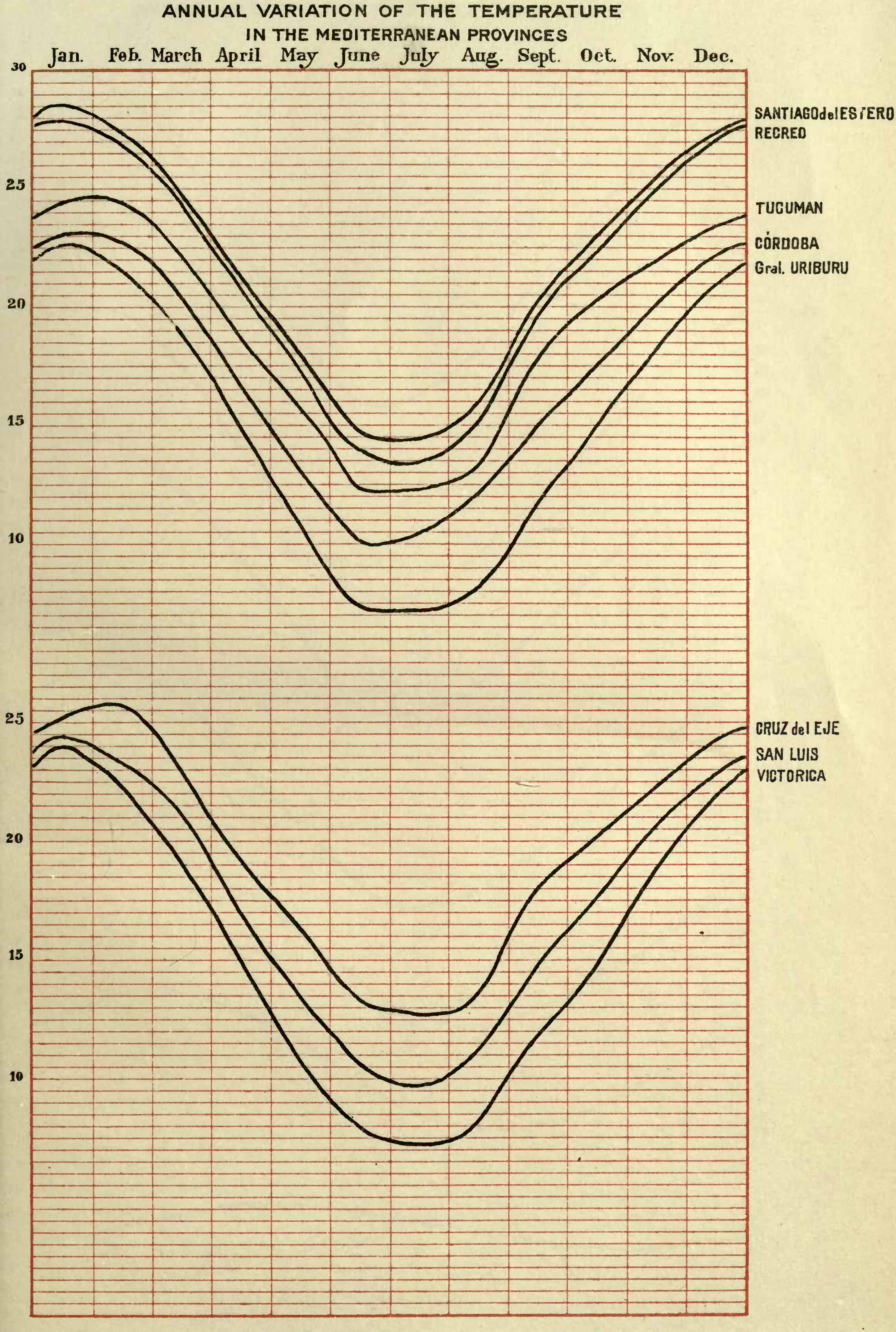
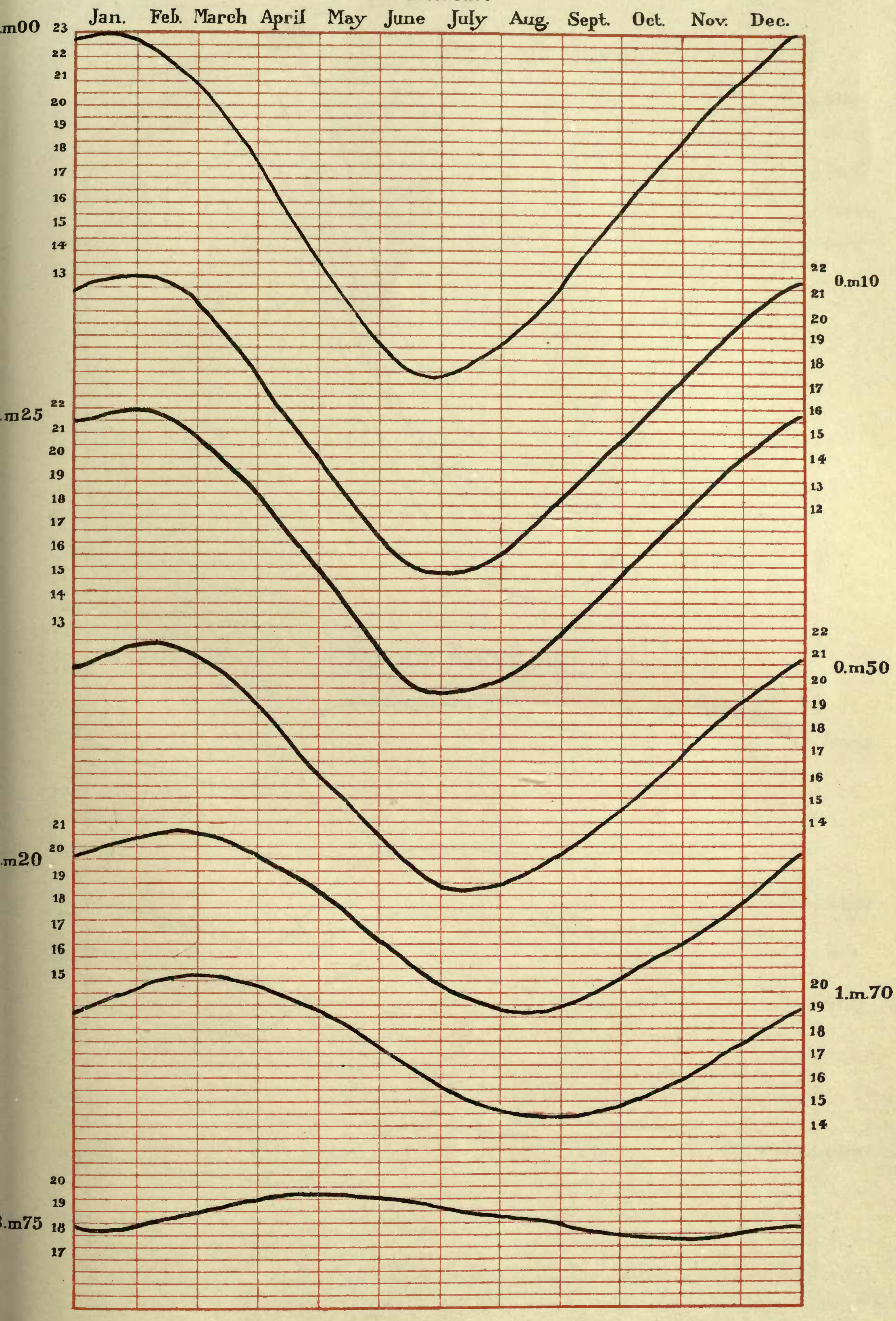
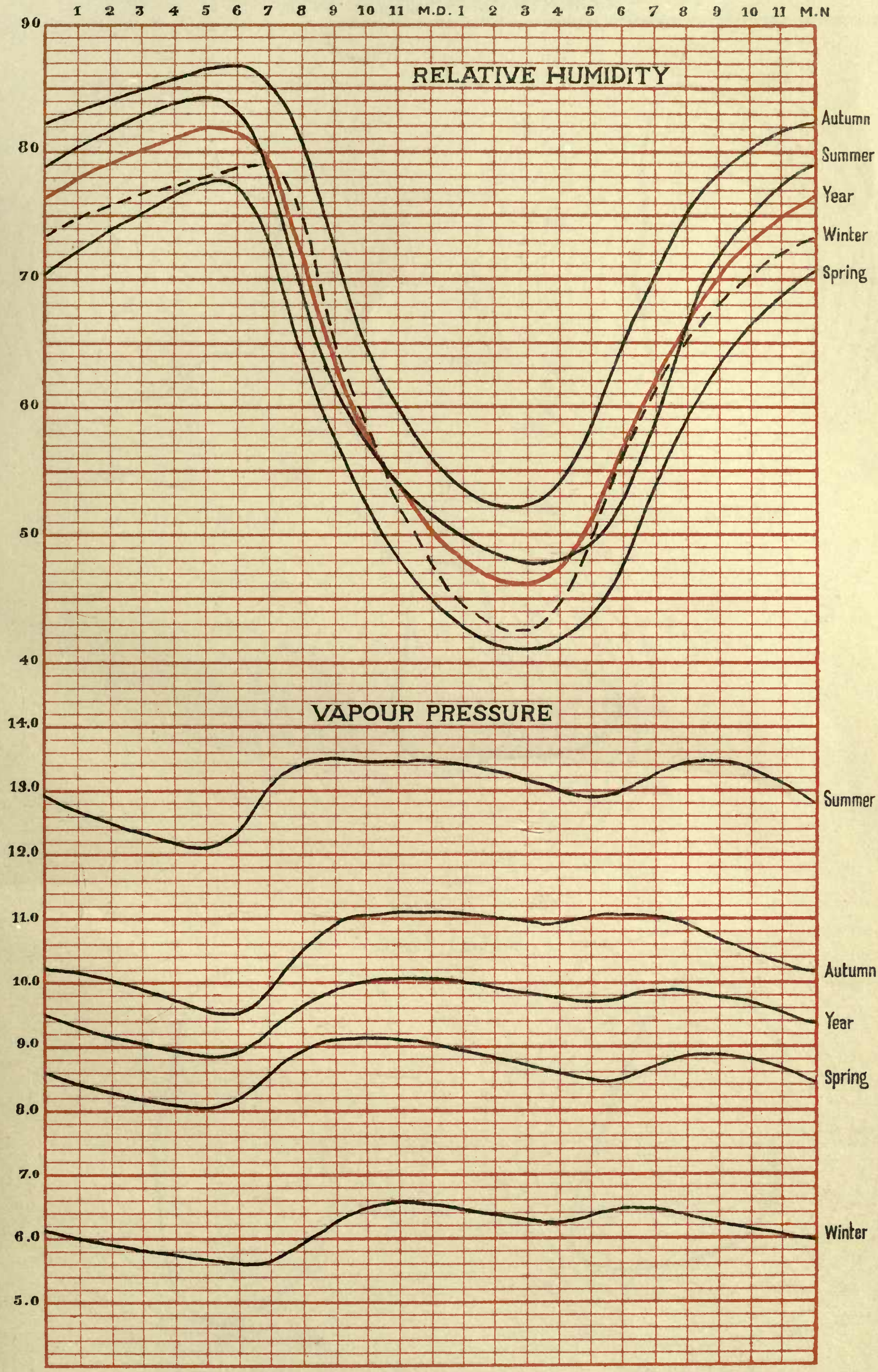

ANNUAL VARIATION OF THE TEMPERATURE
IN THE MEDITERRANEAN PROVINCES
Jan.
Feb.
March
April
May
June
July
Aug.
Sept.
Oct.
Nov.
Dec.
30
25
20
15
10
25
20
15
10
SANTIAGO del ESTERO
RECREO
TUCUMAN
CÓRDOBA
Gral. URIBURU
CRUZ del EJE
SAN LUIS
VICTORICA

Plate XXX

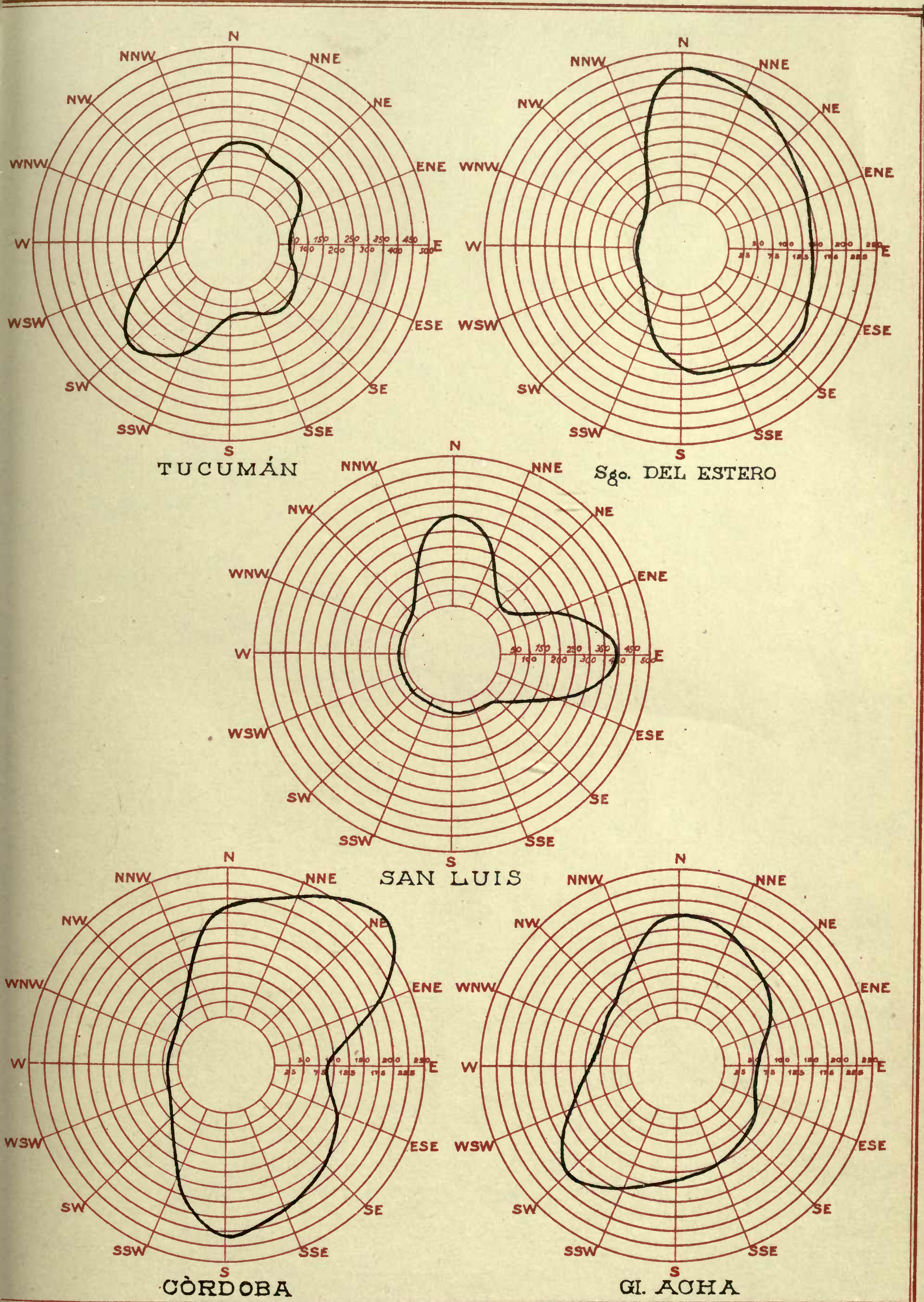
## ANNUAL VARIATION OF THE SOIL TEMPERATURE
### CORDOBA



## DIURNAL VARIATION OF THE RELATIVE HUMIDITY IN CORDOBA



RELATIVE FREQUENCY OF THE WINDS
IN THE MEDITERRANEAN PROVINCES



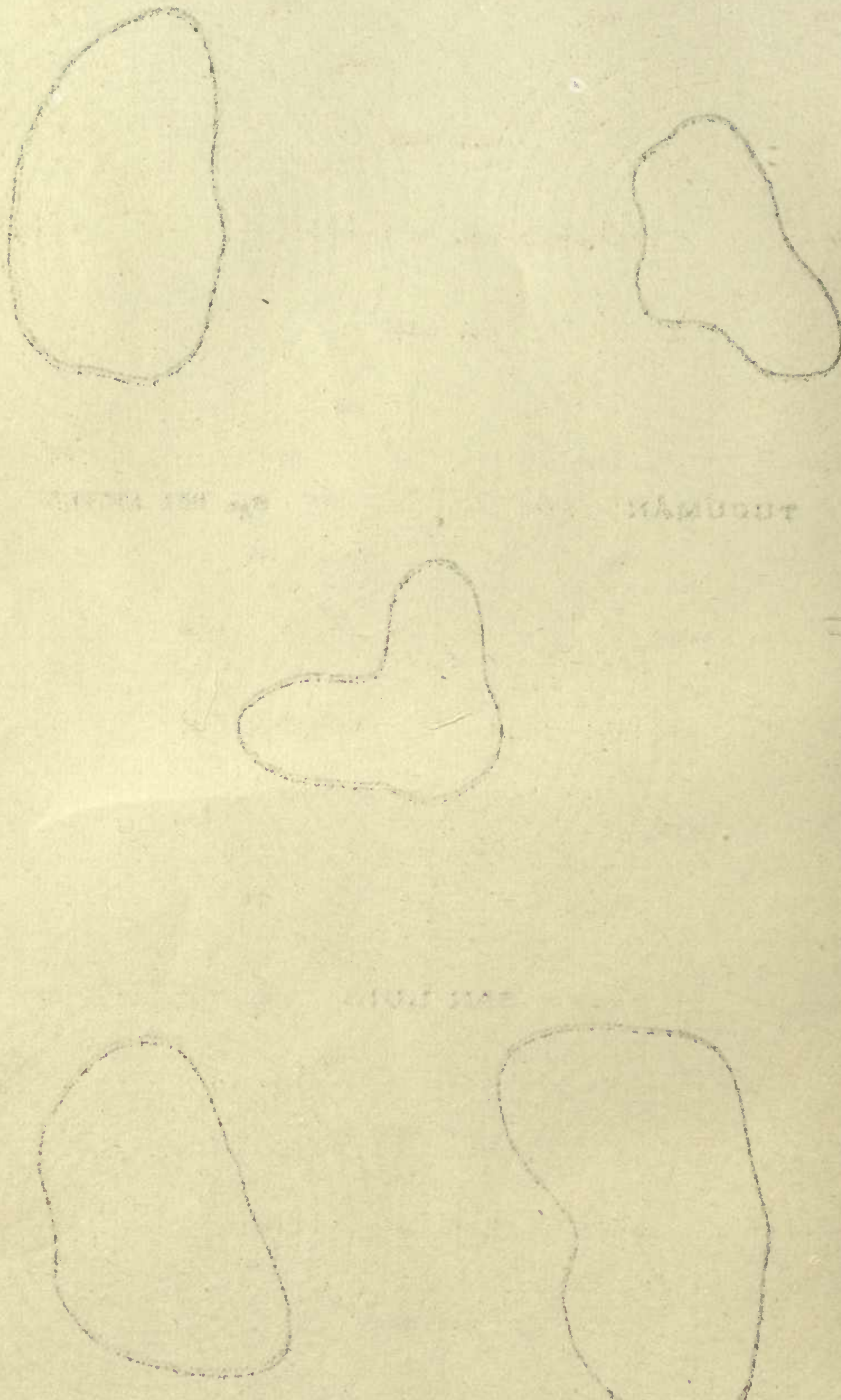
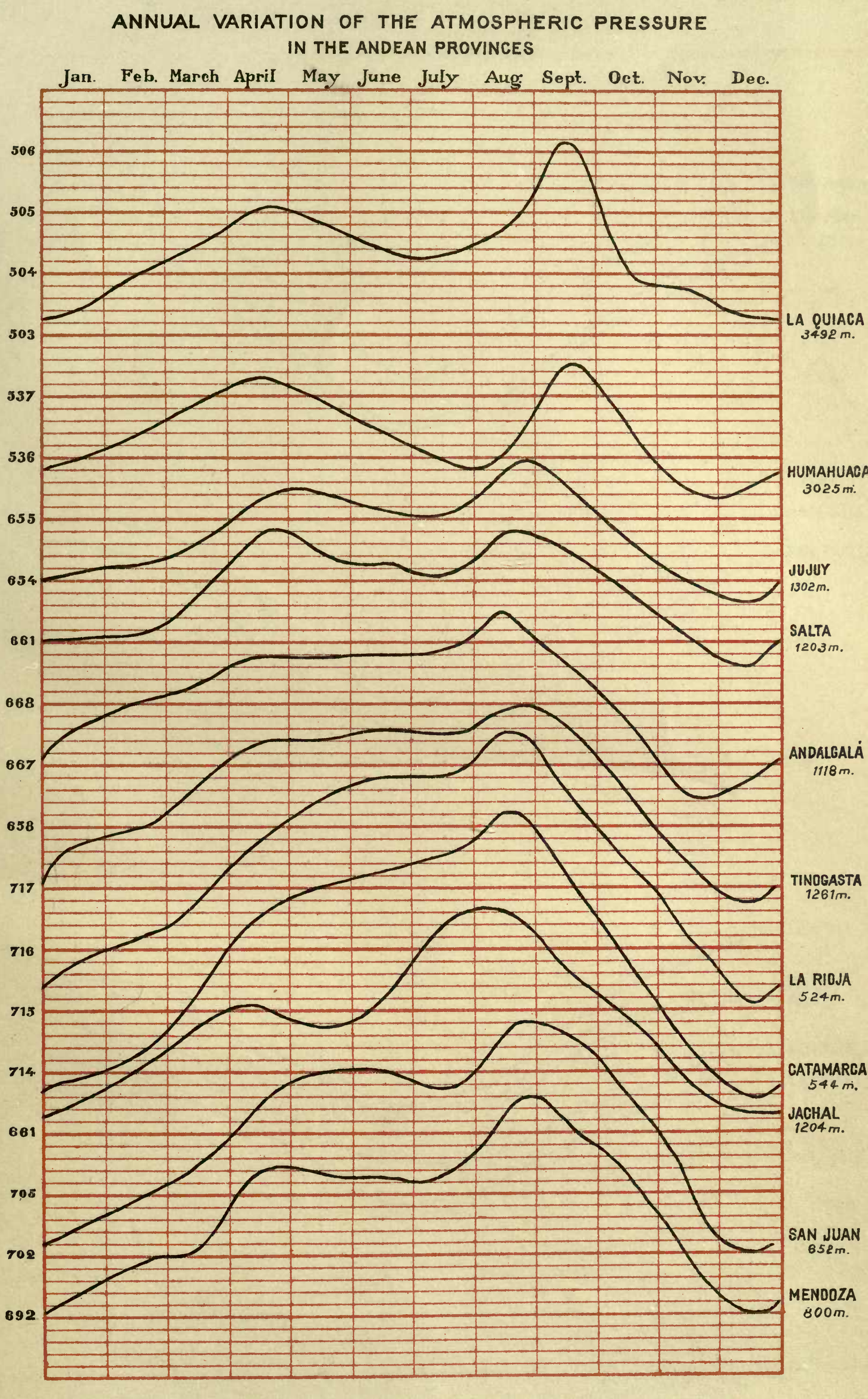
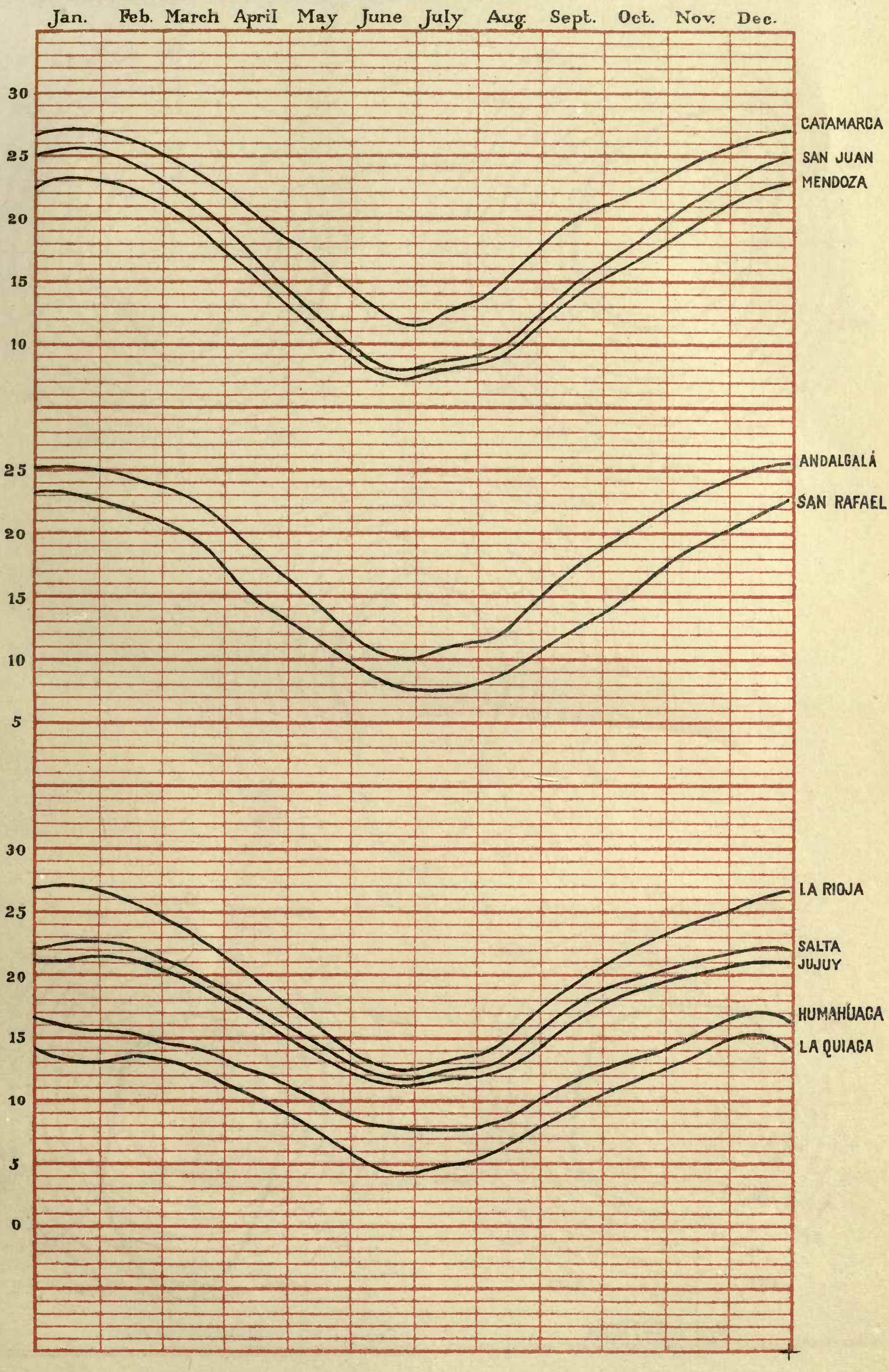


Plate XXXIII

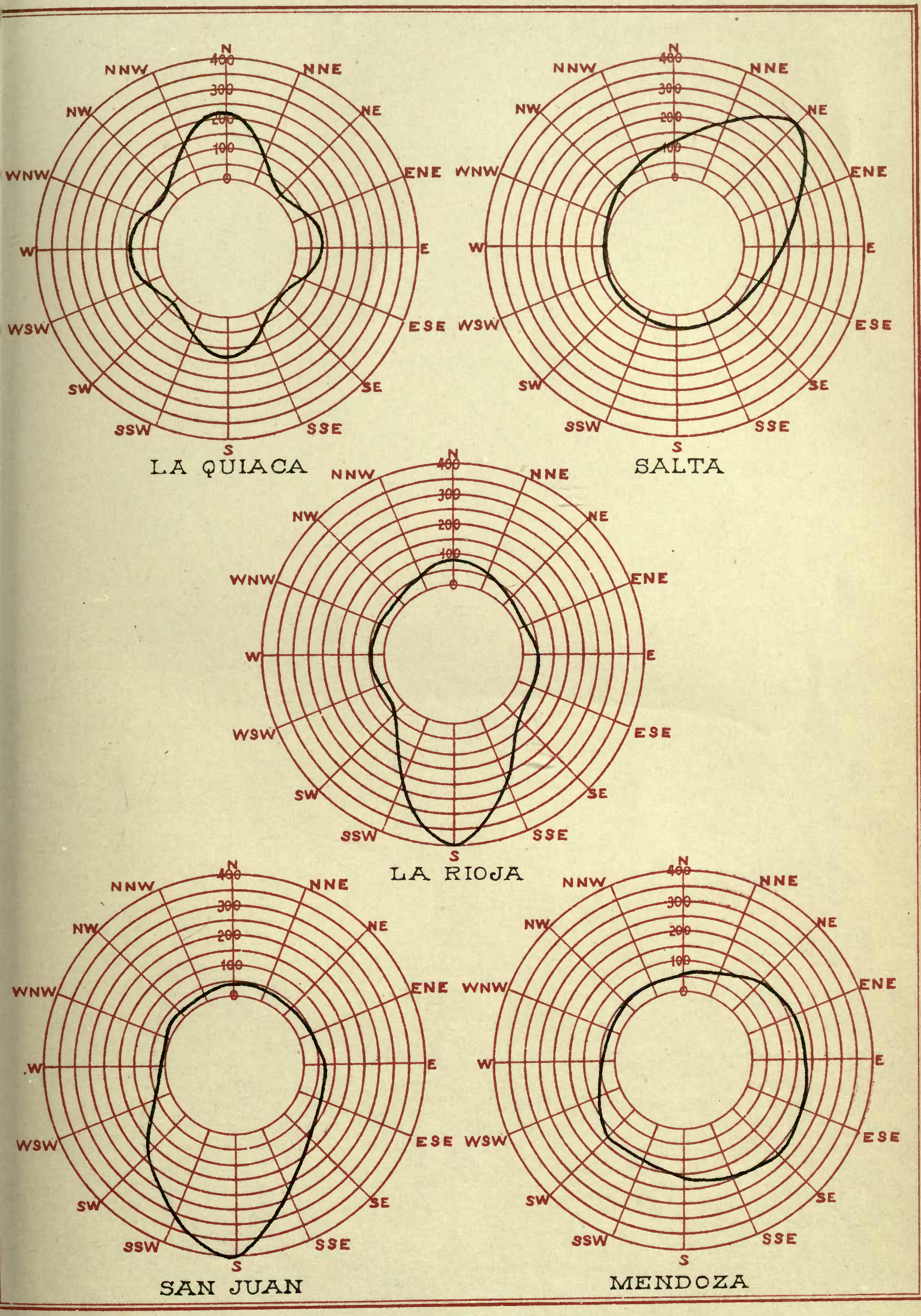


ANNUAL VARIATION OF THE TEMPERATURE
IN THE ANDEAN PROVINCES

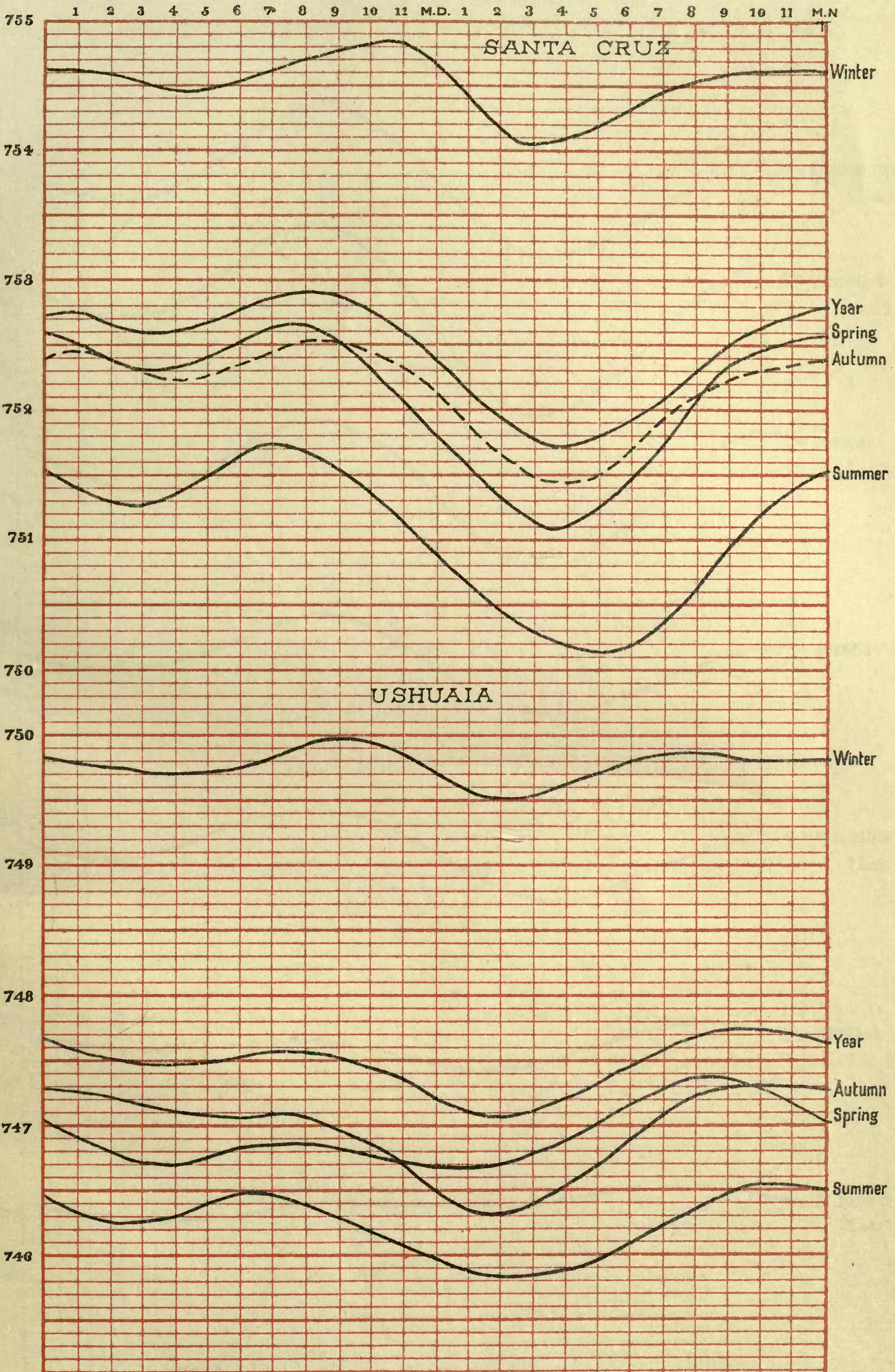


## RELATIVE FREQUENCY OF THE WINDS

### IN THE ANDEAN PROVINCES



## DIURNAL VARIATION OF THE ATMOSPHERIC PRESSURE
### IN THE PATAGONIAN TERRITORIES



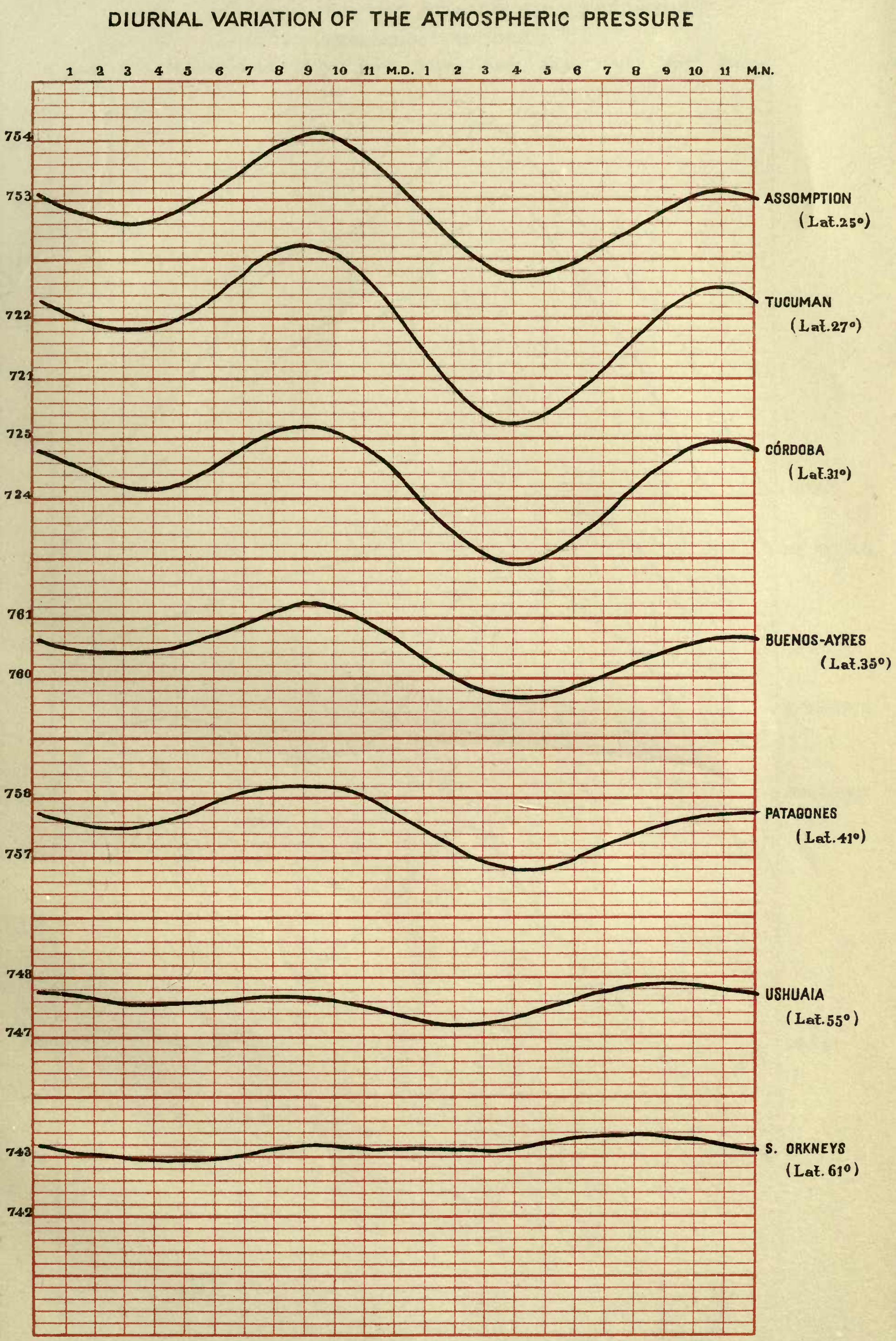
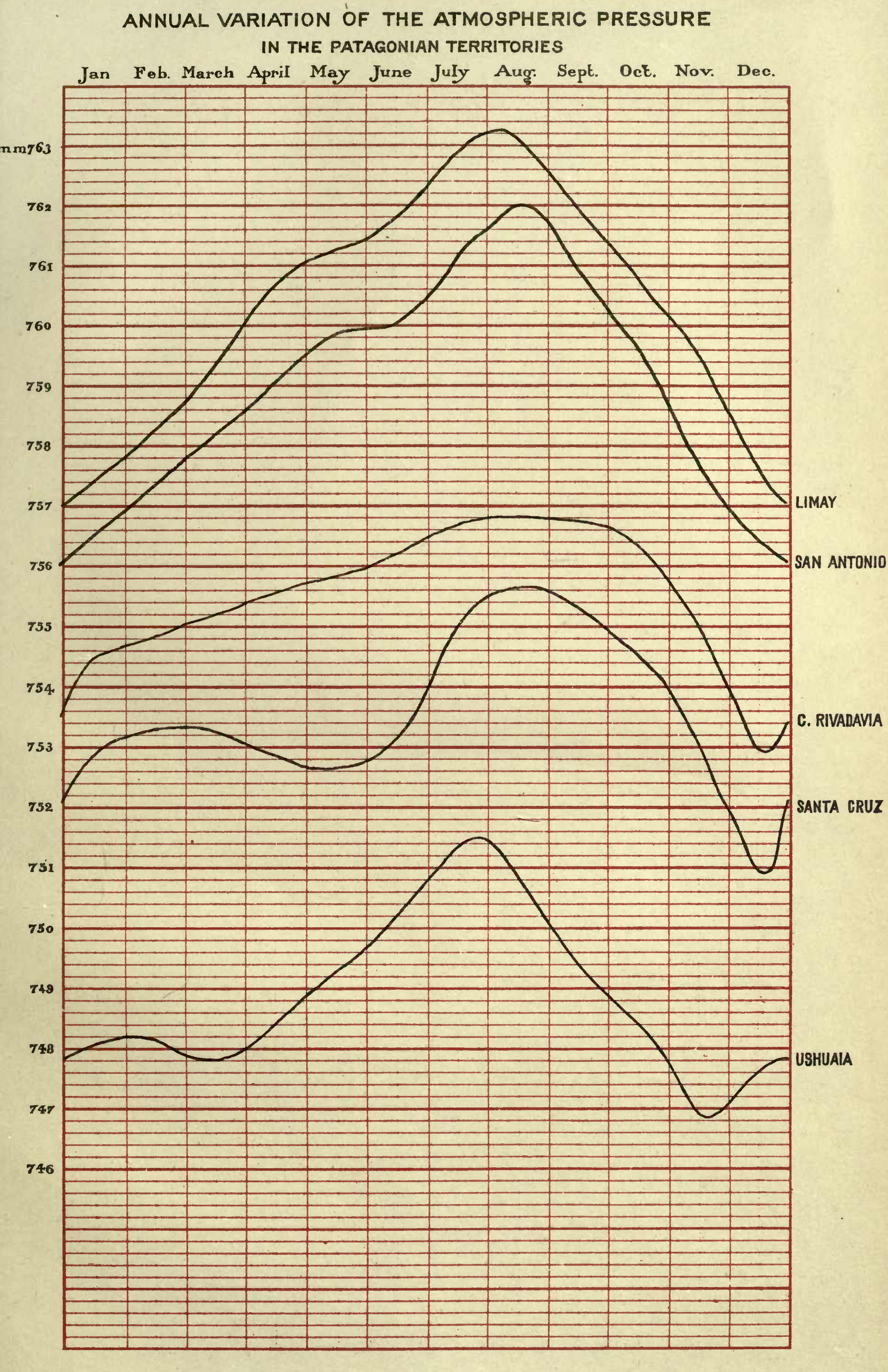
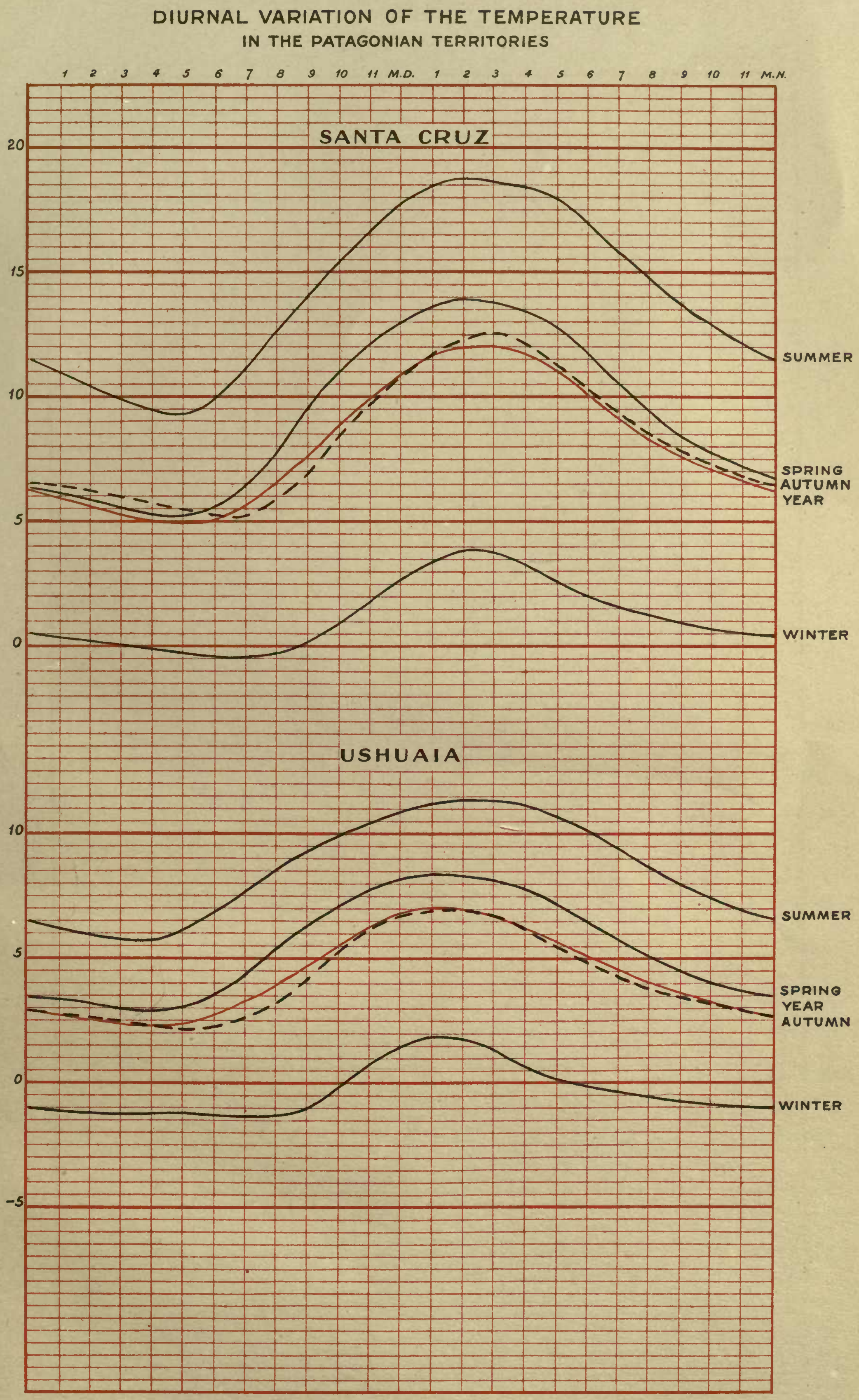
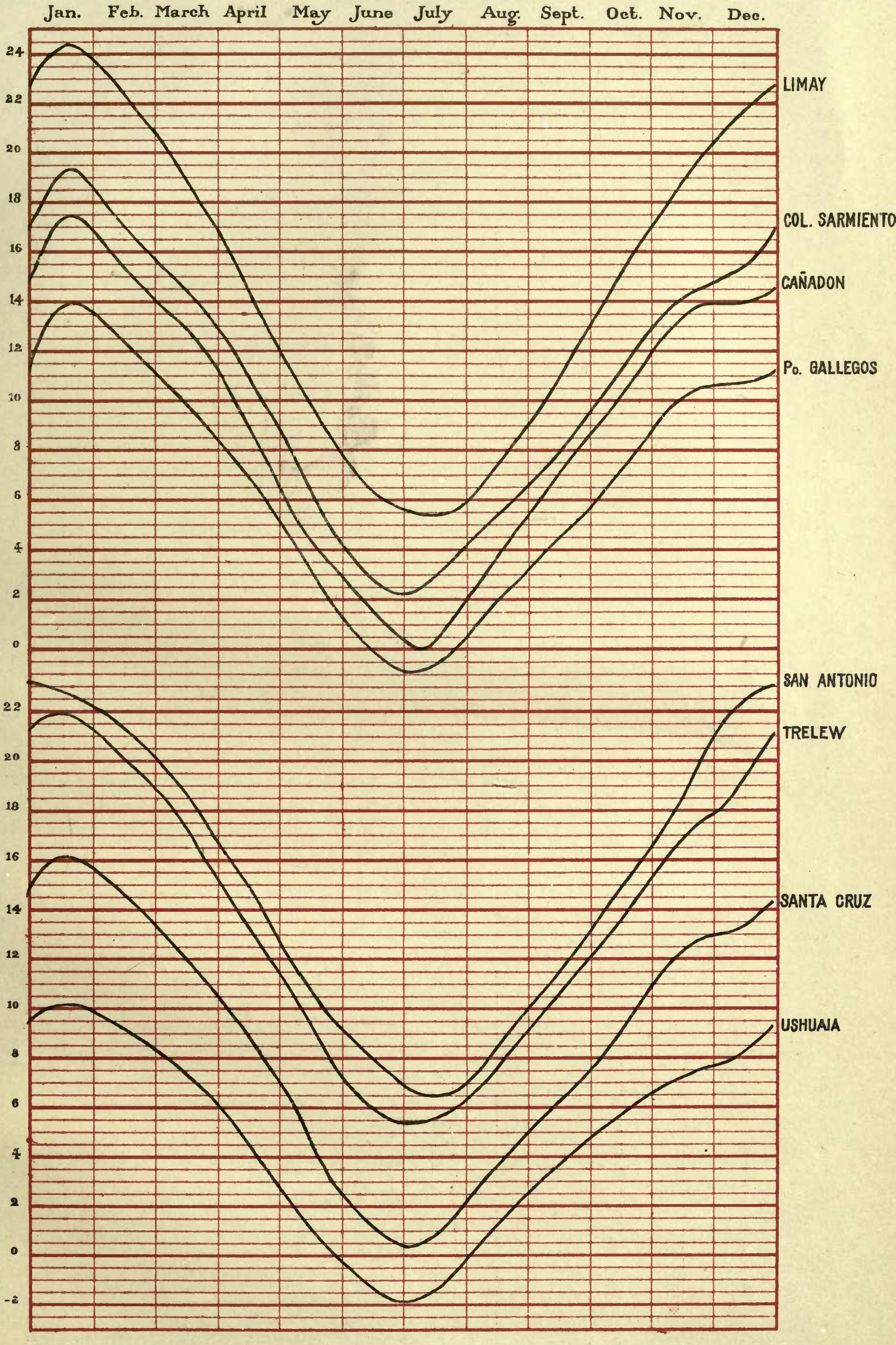

DIURNAL VARIATION OF THE ATMOSPHERIC PRESSURE
1 2 3 4 5 6 7 8 9 10 11 M.D. 1 2 3 4 5 6 7 8 9 10 11 M.N.
754
753
722
721
725
724
761
760
758
757
748
747
743
742
ASSOMPTION
(Lat. 25°)
TUCUMAN
(Lat. 27°)
CÓRDOBA
(Lat. 31°)
BUENOS-AYRES
(Lat. 35°)
PATAGONES
(Lat. 41°)
USHUAIA
(Lat. 55°)
S. ORKNEYS
(Lat. 61°)

Plate XXXVIII

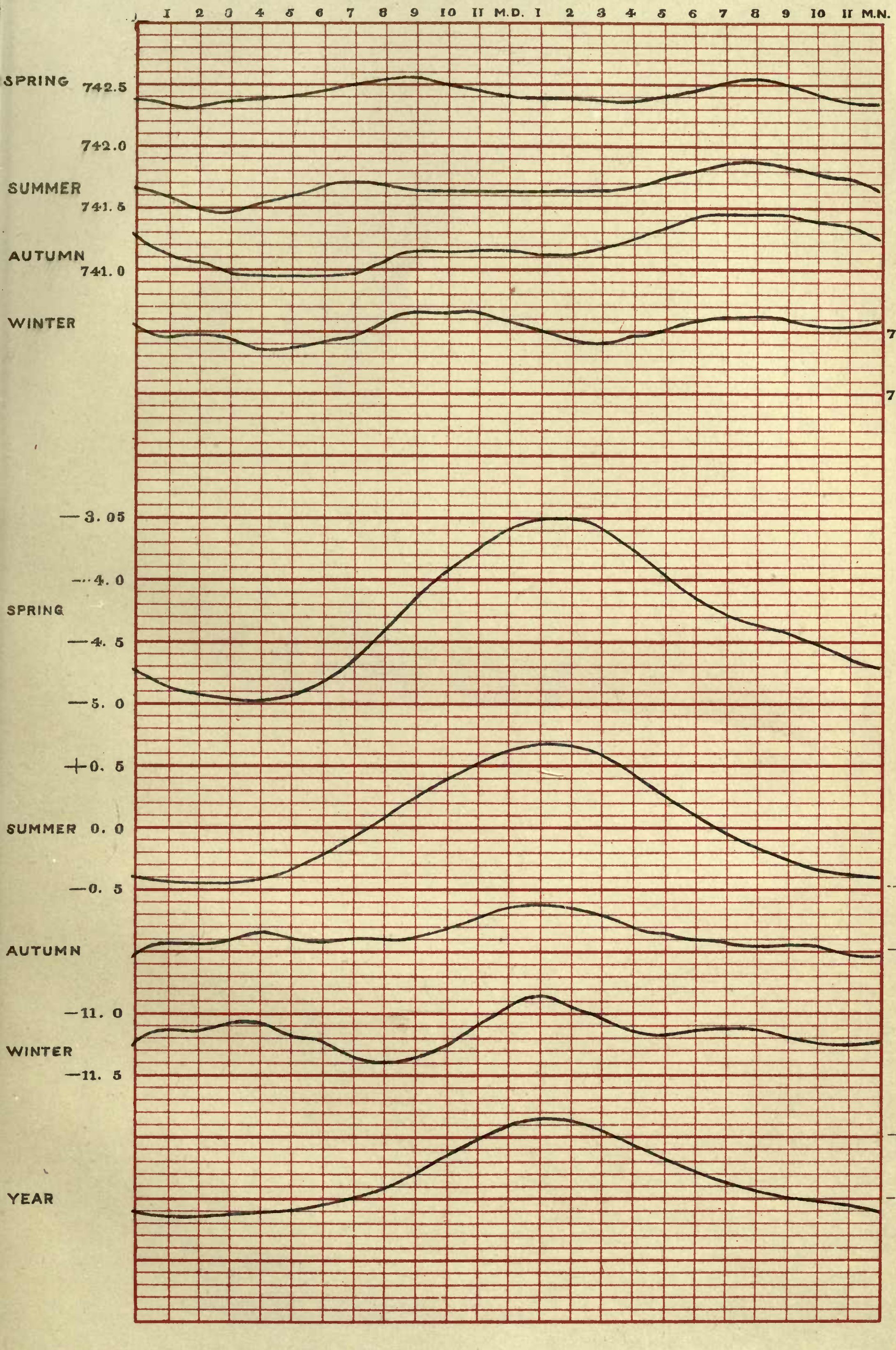



DIURNAL VARIATION OF THE TEMPERATURE
IN THE PATAGONIAN TERRITORIES
1 2 3 4 5 6 7 8 9 10 11 M.D. 1 2 3 4 5 6 7 8 9 10 11 M.N.
SANTA CRUZ
20
15
10
5
0
SUMMER
SPRING
AUTUMN
YEAR
WINTER
USHUAIA
10
5
0
-5
SUMMER
SPRING
YEAR
AUTUMN
WINTER

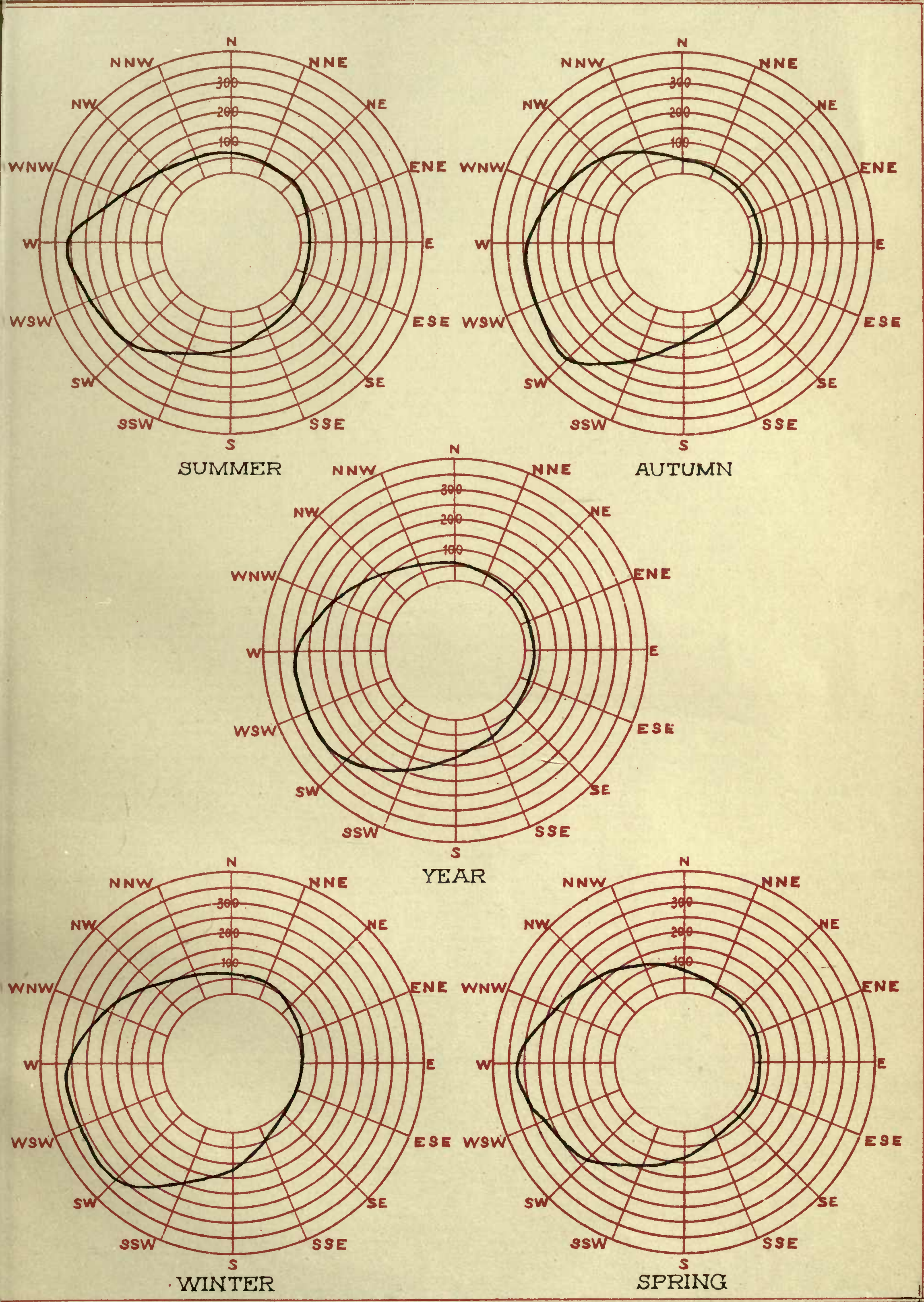
ANNUAL VARIATION OF THE TEMPERATURE
IN THE PATAGONIAN TERRITORIES

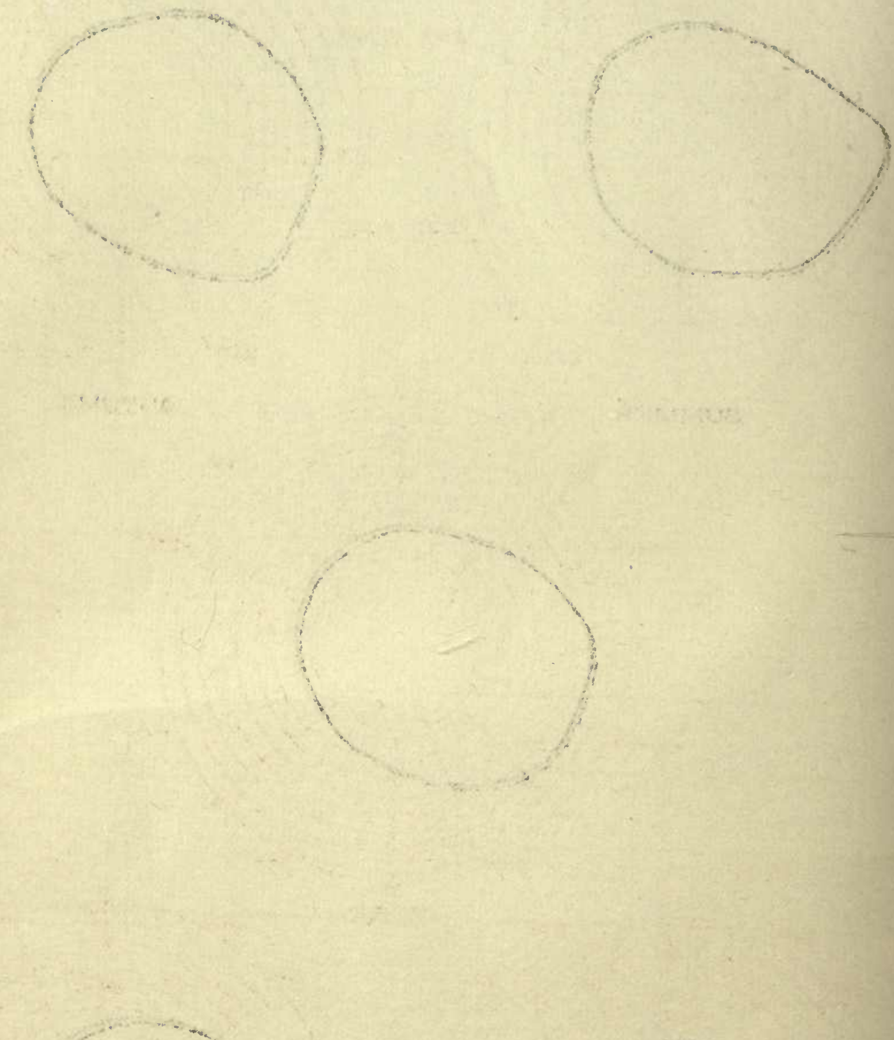


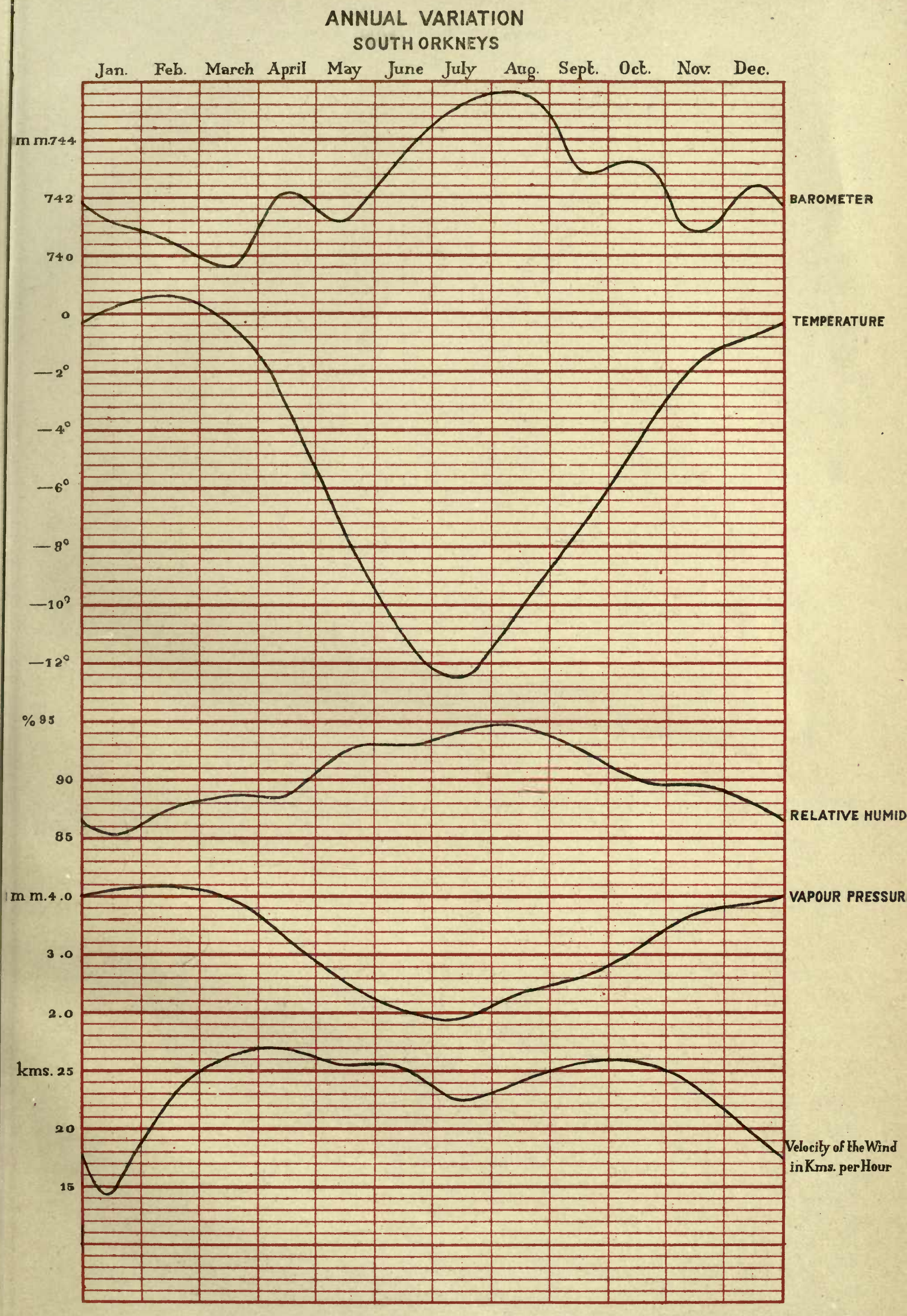
## DIURNAL VARIATION OF THE BAROMETRIC PRESSURE AND OF THE TEMPERATURE AT THE SOUTH ORKNEYS

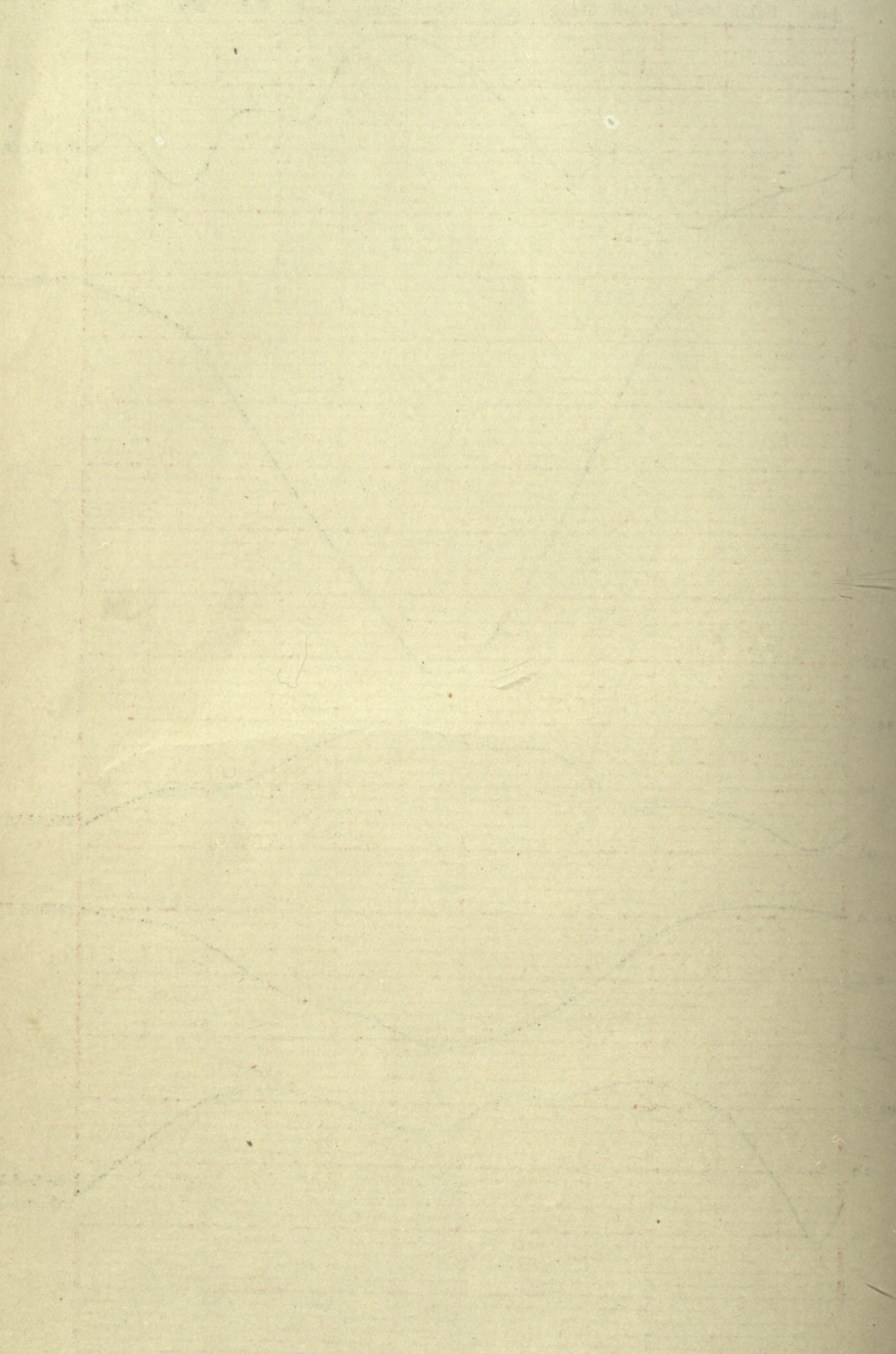


# RELATIVE FREQUENCY OF THE WINDS
## AT THE SOUTH ORKNEYS






ANNUAL VARIATION
SOUTH ORKNEYS
Jan.
Feb.
March
April
May
June
July
Aug.
Sept.
Oct.
Nov.
Dec.
m m.744
742
740
0
—2°
—4°
—6°
—8°
—10°
—12°
% 95
90
85
m m.4 .0
3 .0
2.0
kms. 25
20
15
BAROMETER
TEMPERATURE
RELATIVE HUMID
VAPOUR PRESSUR
Velocity of the Wind
in Kms. per Hour



# MAGNETIC DECLINATION

## EPOCH: JANUARY 1908


Talleres de Impresiones de la Oficina Meteorologica Argentina